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# USSR Report

CHEMISTRY

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CHEMISTRY

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## AEROSOLS

UDC 541.18.02.62-492.2:537

### INFLUENCE OF EXTERNAL ELECTRIC FIELD ON STRUCTURAL-MECHANICAL PROPERTIES OF POWDERED MATERIALS

Moscow KOLLOIDNYY ZHURNAL in Russian Vol 46, No 5, Sep-Oct 84 (manuscript received 23 Jun 83) pp 1039-1041

TOPOROV, Ye.P., SHCHERBINA, G.I., ALEYNIKOVA, I.N., UR'YEV, N.B. and CHERNOMAZ, V.Ye., Institute of Physical Chemistry, USSR Academy of Sciences, Moscow

[Abstract] Powdered polymers (10 micron diameter) and powdered metals (100 micron diameter), with and without a covering layer of powdered polymer, were measured for shear stress with a thixotrometer before and after application of a 4000 V/cm electric field. The field significantly changed the shear stress curve for the powdered polymer and the powdered metal with polymer, but not for the powdered metal alone. When tested in a dynamic vibratory condition, the powders showed a 10% increase in volume when the field was present. The decreased system viscosity may be due to polarization of charged particles by the field. Figures 3; references 2 (Russian). [46-12672]

UDC: 551.510.42(571.17):543.06

### MULTIPLE ELEMENT NEUTRON-ACTIVATION ANALYSIS OF ATMOSPHERIC AEROSOLS WITH X-RAY AND GAMMA-SPECTROMETRIC RECORDING OF RADIONUCLIDES FORMED

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKIKH NAUK in Russian No 11 (386), Jul 84 (manuscript received 14 Apr 82) pp 57-63

PUSHKIN, S. G. and GIL'BERT, E. N., Combined Department of Physical-Chemical and Ecological Problems, Institute of Petrochemistry, Siberian Department, USSR Academy of Sciences, Kemerovo; "Gidrotsvetmet" Institute, Novosibirsk

[Abstract] Neutron activation analysis yields the greatest quantity of information concerning the elemental composition of aerosols. In this work coaxial Ge(Li)- and planar Ge-detectors were used to compare limits of detection and



selectivity of recording of 46 elements determined by the characteristic radiation of 54 radionuclides with half-life over 0.5 days. In the energy area < 160 keV the Ge(Li) detector recorded not over 9 peaks, whereas the planar Ge detector recorded over 60 peaks, indicating much greater selectivity of recording of characteristic radiation for this detector. The Ge detector can decrease the detection limit for many elements as well by 2 to 200 times in comparison to the Ge(Li) detector. Multiple element neutron activation analysis with one-time bombardment of aerosol samples by a flux of thermal neutrons of about  $6 \cdot 10^{13}$  neutrons per square centimeter per second for 10 hours with 4 measurements of characteristic radiation of radionuclides with half-lives over 0.5 days has significantly increased the number of simultaneously determined elements, expanded the range of concentrations studied and reduced the total analysis time of many elements. Figures 2, references 14: 10 Russian, 4 Western.  
[388-6508]

UDC: 551.510.42

#### ONE MECHANISM OF FORMATION OF ORGANIC FRACTION IN ATMOSPHERIC AEROSOL

Leningrad ZHURNAL PRIKLADNOY KHIMII in Russian Vol 57, No 9, Sep 84 (manuscript received 11 Oct 83) pp 1978-1982

MORACHEVSKIY, V. G., ZVENIGORODSKIY, S. G. and SMYSHLYAYEV, S. P., Leningrad Institute of Hydrometeorology

[Abstract] A new mechanism is suggested for development and growth of organic aerosol particles - heterogeneous reactions with organic matter in the gas phase. Reactions in the atmospheric methane cycle are suggested as a source of such surface-active organic formations. Processes determining the diurnal course of this component at the level of the earth's surface are analyzed. It is found that at night, methane-hydroperoxide is not formed, but as the sun rises the concentration of NO increases quite suddenly, while OH and HO<sub>2</sub> increase more smoothly. On cloudy days the daily maximum of production of CH<sub>3</sub>OOH is less pronounced. During the hours after sunrise the concentration of OH and HO<sub>2</sub> increases, increasing the production of CH<sub>3</sub>OOH, which reaches its maximum around noon. After 1 pm the concentration of OH decreases, while that of NO remains at its previous level, decreasing the rate of formation of CH<sub>3</sub>OOH. The total quantity of CH<sub>3</sub>OOH absorbed on the surface of aerosol particles as a result of heterogeneous interactions during one day is calculated. Figures 4, references 6: 4 Russian, 2 Western.  
[34-6508]

UDC 541.182:535

OPTICAL CONSTANTS OF MATERIALS OF DISPERSED MEDIA IN INFRARED SPECTRAL REGION

Moscow KOLLOIDNYY ZHURNAL in Russian Vol 46, No 5, Sep-Oct 84 (manuscript received 29 Jun 83) pp 999-1002

AL'PEROVICH, L.I., ANDRONOVA, A.V., MAMCHENKO, T. B., SUTUGIN, A.G., CHISTYAKOVA, I.V. and SHARKAYEVA, L.G., Scientific Research Physico-Chemical Institute imeni L. Ya. Karpov, Moscow

[Abstract] A method of determining the adsorption coefficient and refractive index of powdered substances was developed using ammonium chloride. A finely dispersed aerosol was collected by sedimentation on a transparent substrate to a thickness of 4-7 microns. The first approximation of the adsorption coefficient and the refractive index were based on the density of a solid crystal and the measured density of the layer and its transmission spectrum. These values were used to calculate a reflection spectrum which agreed well with that of a monocrystal. Figures 3; references 7: 5 Russian, 2 Western. [46-12672]

UDC: 543.42:615.33

COMPLEX COMPOUNDS OF PYROCATECHIN VIOLET WITH ALUMINUM AND AMINOGLYCOCIDE ANTIBIOTICS

Moscow ZHURNAL ANALITICHESKOY KHIMII in Russian Vol 39, No 8, Aug 84 (manuscript received 25 Oct 83) pp 1425-1427

ALYKOV, N.M., Astrakhan Pedagogic Institute

[Abstract] A method is described for determining 0.02-50 µg aminoglycosides in biological fluids by means of compounds of aluminum with pyrocatechin violet. Pyrocatechin violet forms a complex compound with an Al:PV ratio of 1:1 with aluminum ions in aqueous solutions in the pH range 3-7. The compound has a maximum of absorption at 580 nm. With an excess of PV in the presence of Al and aminoglycoside antibiotics, compounds are formed with maximum long-wave absorption band at 665 nm, which precipitate over time. The influence of pH, ethanol/water ratio, ionic strength of solutions, temperature

and other factors on the formation of the latter compounds was studied. A method was developed for identification on chromatograms and quantitative determination of aminoglycosides in blood and milk. Figure 1; references: 2 Russian.  
[386-6508]

UDC: 543.546.84

#### PHOTOMETRIC DETERMINATION OF THORIUM IN PRESENCE OF RARE EARTH ELEMENTS AND URANIUM

Moscow ZHURNAL ANALITICHESKOY KHIMII in Russian Vol 39, No 8, Aug 84 (manuscript received 11 Jul 83) pp 1440-1444

GAMBAROV, D. G., AYUBOVA, A. M. and NGUYEN CHI CHY, Azerbaijan State University imeni S. M. Kirov, Baku

[Abstract] It is demonstrated that 2,3,4,-trioxy-4'-sulfoazobenzene (TSAB) can be used for photometric determination of thorium in the presence of large quantities of uranium and rare earth elements. A  $1 \cdot 10^{-3}$  M aqueous solution of TSAB was prepared with a precise charge of twice recrystallized Th  $(\text{NO}_3)_4 \cdot 4\text{H}_2\text{O}$ . It is found that at pH 2.0 and 5.5, the absorption of the complex of thorium (IV) with TSAB is maximal at 420 nm, that of the reagent - at 380 nm. Optimal conditions, composition and stability constant of the complex are computed. A method is developed for determining thorium with TSAB at pH 2 in the presence of 7500 and 4000 times quantities of rare earth elements and uranium. The relative standard deviation is 0.005-0.04. Figures 4; references: 9 Russian.  
[386-6508]

UDC: 543.8:564.17

#### SEMI-AUTOMATIC DETERMINATION OF NITROGEN IN ORGANIC SUBSTANCES

Moscow ZHURNAL ANALITICHESKOY KHIMII in Russian Vol 39, No 8, Aug 84 (manuscript received 24 Feb 83) pp 1508-1514

CHUMACHENKO, M. N., VIKINA, N. M., SEMENOVA, V. N. and NOVIKOVA, O. V., Institute of Physiologically Active Substances, USSR Academy of Sciences, Chernogolovka

[Abstract] A laboratory semiautomatic device is described allowing the production of reliable results in the analysis of organic substances of various compositions and structures. Nitrogen-containing organic substances are oxidized by  $\text{NiO}$  at high temperature in an atmosphere of helium. The oxidation conditions are static. An important advantage of the method of oxidation is the absence of oxides of nitrogen in the combustion products, full oxidation of carbon to carbon dioxide at  $1050^\circ\text{C}$  and high absorptive

capacity of the oxidizer for halogens including fluorine and oxides of sulfur. After oxidation, nitrogen is determined by a modernized chromatograph. The accuracy of determination is 0.1-0.2% absolute, standard deviation for substances of various composition and structure 0.01-0.02%. The time of one determination is 15 minutes, consumption of the substance being determined 0.3-2 mg. Figure 1; references 13: 4 Russian, 9 Western.  
[386-6508]

UDC: 543.81:543.426

#### LUMINESCENT-PHOTOCHEMICAL ASSAY OF CHLORINE-CONTAINING AROMATIC COMPOUNDS AND PESTICIDES IN WATER

Moscow ZHURNAL ANALITICHESKOY KHIMII in Russian Vol 39, No 8, Aug 84 (manuscript received 18 Feb 83) pp 1518-1520

KARYAKIN, A. V., Institute of Geochemistry and Analytic Chemistry imeni V. I. Vernadskiy, USSR Academy of Sciences, Moscow

[Abstract] The purpose of this work was to develop a rapid, highly sensitive method for determining chlorine-containing aromatic compounds including pesticides in water with preliminary splitting of chlorine atoms bonded in organic molecules by effects of UV radiation and assay of the chloride ions formed by a luminescent method. The method was used to determine the content of aromatic chlorine compounds including chlorobenzene, DDT, HCCH, phasalon and nicotax (2-methyl-4-chlorophenoxyacetic acid). It is shown that irradiation of aqueous solutions of these chlorine-containing organic substances by ultraviolet radiation at 253.7 nm wavelength results in splitting of the chlorine atoms as chloride ions in quantities proportional to the atoms in the aromatic ring. The chloride ions in the aqueous solutions can be assayed by luminescence at liquid nitrogen temperatures of the bismuth chloride formed upon interaction with bismuth (III). The method of determination allows for a low boundary of the content which can be determined,  $10^{-5}$ - $10^{-6}\%$ . References 5: 2 Russian, 3 Western.  
[386-6508]



## CATALYSTS

### AMMONIA SYNTHESIS AND HOMOGENOUS CATALYSIS

Moscow LENINSKOYE ZNAMYA in Russian 16 Sep 84 p 4

[Article by O. Yefimov, laboratory chief at the Chemical Physics Institute, USSR Academy of Sciences, candidate of chemical sciences, Noginskiy Rayon: "The Art of Controlling a Reaction"]

[Text] Scientists have long known how to accelerate chemical reactions. They do this with catalysts, substances which are not themselves used up in the reaction, yet without which the reaction either does not take place at all or goes very slowly. For example, you can heat a mixture of nitrogen and hydrogen as long as you like, but nothing happens until you pass the mixture over catalysts, in this case iron oxides with added aluminum and potassium oxides. Only then does the mixture react to form ammonia. A method for synthesizing ammonium from nitrogen and hydrogen, along with a catalyst for this process, was developed in the early 20's by the prominent chemist Haber. Since this time, enormous quantities of ammonia have been manufactured by this method, most of which is used in the synthesis of nitrogen fertilizers.

A modern ammonia factory is a complex, highly automated plant. The raw materials for synthesizing ammonia are the pure gases hydrogen and nitrogen. Hydrogen is obtained from natural gas and nitrogen from the air. This synthesis takes place under very severe conditions, at pressures of 200 atmospheres and temperatures of 500-550°C. Now imagine the surprise of the chemists when the biologists announced that there are bacteria living in the soil which can produce ammonia from atmospheric nitrogen with no need for either hydrogen or superhigh temperatures. These bacteria produce a major part of the bound nitrogen needed for the growth of plants.

For a long time this process remained unclear. Guesses and hypotheses were ventured, but only one thing was known for sure: the bacteria could not bind nitrogen if the soil did not contain microadmixture of molybdenum compounds. Thus, nature itself was hinting to the chemists that the catalyst for nitrogen-binding (called by the biologists nitrogenesis) should include molybdenum.

The riddle of the biological fixation of nitrogen was solved by a scientist at a branch of the Chemical Physics Institute of the USSR Academy of Sciences (in the Chernogolovka settlement) under the guidance of Corresponding Member of the USSR Academy of Sciences A. E. Shilov. They were the first to discover the simple chemical catalysts, containing molybdenum ions, which were

responsible for the reduction of nitrogen to ammonia in an aqueous or aqueous-alcohol solution. Now the chemists have come to the aid of the biologists, and the chemical model has become fundamental for explaining the process which takes place in bacteria.

Scientists from the Heteroorganic Compounds Institute of the USSR Academy of Sciences took another approach. A leading Soviet scientist in the area of metalorganic chemistry and catalysis, Corresponding Member of the USSR Academy of Sciences, M. E. Vol'pin and his student V. B. Shur, showed that, under the action of strong reducing agents, the compounds of many metals become capable of reacting with nitrogen in an organic solvent to form nitrides, compounds of nitrogen and a metal. If one then reacts the solution with oxygen, ammonia can be isolated from it.

The work which we have been discussing is only a small part of the studies being carried out by Soviet scientists in the new area of catalysis called homogeneous catalysis. The term derives from the fact that all the participants in the reaction (both reagents and catalyst) are in solution. In traditional, or heterogeneous catalysis, the catalyst is a solid and the reagents can be liquid, vapor or gas, as in the Haber synthesis.

Scientists have come up with many different homogeneous catalysts. These can be used, for example, to bring about the reaction in solution of such hydrocarbons as methane, or to convert carbon monoxide or carbon dioxide into hydrocarbons.

Homogeneous catalytic reactions are of interest primarily because they are rather easy to study. In solution, one can follow all the stages of transformation of a substance, from its binding to the catalyst to the final reaction products. One can even isolate intermediate compounds and determine their structure. In other words, it is possible to determine the reaction mechanism in detail, which is extremely difficult in the case of heterogeneous catalysis.

But it should not be supposed that homogeneous catalysts are of purely academic interest. Many processes involving such catalysts are already used in industry. These processes take place under less severe conditions, produce fewer side products, and have a high yield. Thus, for example, a large part of the olefins (raw material for organic synthesis) polymerize under the action of soluble catalysts. Polyethylene and polypropylene, obtained by this method, find widespread application in the national economy, being used for the manufacture of transparent films, tubes, packaging materials, machine components, and many other products.

Of great importance to industry are catalytic syntheses based on methyl alcohol, used very widely in the USSR. Carbon monoxide and methyl alcohol can easily, in a single step, be reacted to form acetic acid, a basic material for the manufacture of synthetic fibers. It is interesting to note that the solvent in this reaction is acetic acid itself.

At the present time natural gas serves as the starting material for the production of carbon monoxide and methyl alcohol. But the time is approaching

when chemists will begin the technological chain with coal, of which we have large reserves.

Homogeneous catalysis has opened up new pathways for chemical science and for industry. It is therefore particularly important that knowledge be exchanged among scientists, technologists and engineers working in this area. For this purpose, the Chemical Physics Institute of the USSR Academy of Sciences, in collaboration with the union ministries and the chemical industry for mineral fertilizers and agriculture, has organized an International Symposium on Homogeneous Catalysis, to take place in Leningrad in late September, attended by 700 representatives from 27 countries.

9832

CSO: 1841/29

UDC 541.128.12

**ALUMINA-PLATINA CATALYSTS WITH ADDITIONS OF TUNGSTEN IN n-HEXANE AROMATIZATION REACTIONS**

Leningrad ZHURNAL PRIKLADNOY KHIMII in Russian Vol 57, No 8, Aug 84 (manuscript received 27 Sep 83) pp 1735-1739

NADIROV, N.K. and PETROSYAN, L.S.

[Abstract] It was previously shown that additions of tungsten to alumina-platina catalysts increase their activity and selectivity in hydrocarbon aromatization reactions. The present work is devoted to studying the physical chemical properties of these alumina-platina-tungsten catalysts and their effect on n-hexane aromatization to benzene. The promoting effects are apparently due to interaction of the catalyst components between themselves and the carrier resulting in higher dispersion and increased heat resistance of the platinum particles, and a change in the acid-base properties of the aluminum oxide. Figures 2; references 4 (Russian).  
[24-12765]

UDC 542.973

**PHYSICAL CHEMICAL PROPERTIES OF MOLTEN  $K_2O-V_2O_5$  CATALYST IN REACTION-REGENERATION CYCLE**

Leningrad ZHURNAL PRIKLADNOY KHIMII in Russian Vol 57, No 8, Aug 84 (manuscript received 13 Jul 83) pp 1872-1876

FAZLEYEV, M.P., CHEKHOV, O.S. and YERMAKOV, Ye.A., Institute of Continuum Mechanics, UNTs [Ural Science Center?], USSR Academy of Sciences

[Abstract] Molten  $K_2O-V_2O_5$  is both a catalyst and medium for conducting gas-liquid reactions to obtain such products as styrene, formaldehyde and acetaldehyde, and theoretical and practical problems in designing reactors for these processes require data on the physical chemical properties of the molten catalysts. Direct contact of hydrocarbons with the above catalyst in



the absence of oxygen results in gradual reduction of  $V^{+5}$  to  $V^{+4}$  thereby altering both catalyst selectivity and activity, while catalytic oxidation of hydrocarbons may result in coke formation. A study of the changes in composition, surface tension and density of molten catalyst showed that  $V_2O_4$ , formed in a reducing mixture of gases, has limited solubility in the molten catalyst, lowers the surface tension and increases the density. It may be regenerated by air-blowing. Coke formed during hydrocarbon oxidation has a plate-like structure and is evenly distributed throughout the catalyst. Excess air during oxidation results in explosive combustion of the coke. Figures 2; references 9: 8 Russian, 1 Western.  
[24-12765]

UDC: 66.097.3:539.4:620.193.4

#### CHANGE IN STRENGTH OF NICKEL MIXED CATALYSTS WITH ACTIVATION

Leningrad ZHURNAL PRIKLADNOY KHIMII in Russian Vol 57, No 9, Sep 84 (manuscript received 21 Sep 83) pp 1968-1973

BEL'MES, M. N., GRECHENKO, A. N. and GOLOSMAN, Ye. Z.

[Abstract] A study is presented of the change in strength characteristics of nickel catalysts during the first stage of operation, activation of the catalysts. Catalysts were mechanically tested in the form of cylindrical tablets 5-6 mm in diameter and 5 mm high by crush testing.  $NiO-Al_2O_3$  and  $NiO-CaO-Al_2O_3$  catalysts were tested, prepared by tableting calcined nickel-aluminum or nickel-aluminum-calcium masses, some specimens then subsequently calcined again as tablets. The nickel catalysts are activated in a medium of reducing gases, frequently containing hydrogen. Studies with heating in air and in hydrogen showed that, without phase transformations, relaxation in residual internal stresses arising during pressing leads to an increase in the strength of the catalysts. A change in the phase composition of the catalysts due to reduction of oxide phases and decomposition of calcium carbonate is the most probable reason for the observed decrease in strength of catalyst tablets in the activating medium. References: 14 Russian.  
[34-6508]

STUDY OF COPPER CATALYSTS OF HYDRATION OF ACRYLONITRILE

Leningrad ZHURNAL PRIKLADNOY KHIMII in Russian Vol 57, No 9, Sep 84 (manuscript received 23 Dec 82) pp 2049-2053

FASMAN, A. B., LIFANOVA, V. A., YERMOLAYEV, V. N. and KALINA, M. M., Saratov Branch, Scientific Research Institute of Polymers imeni V. A. Kargin; Institute of Organic Catalysis and Electrochemistry, Kazakh SSR Academy of Sciences

[Abstract] The purpose of this work was to establish the relationship between phase composition and activity of copper catalysts produced by various methods, as well as the nature of additives of certain metals and the activity of skeletal copper. Eight catalyst specimens were studied, produced by decomposition of copper oxalate in hydrogen, by wet mixing of the nitrates of copper, zinc and aluminum with subsequent heating and reduction in hydrogen, by leaching of Cu-Me-Al alloys with 20% aqueous KOH, and by treatment of skeletal copper catalysts with a solution of sodium tetrachloropalladate. The specimens were found to have similar phase composition and activity in hydration of acrylonitrile. The addition of Zn, Cr, Ti and Ni decreased the activity of skeletal copper, while Ni changed the direction of the reaction. Figures 3; references: 4 Western.  
[34-6508]

UDC: 542.97:541.13

CATALYTIC EFFECT OF BIS(TRIBUTYLTIN)CARBODIIMIDE AND TRIS(TRIBUTYLTIN)ISOCYANURATE

Leningrad ZHURNAL PRIKLADNOY KHIMII in Russian Vol 57, No 9, Sep 84 (manuscript received 20 Dec 82) pp 2053-2057

NOSKOV, N. M. and DERGUNOV, Yu. I., Dzerzhinsk Branch, State Scientific Research and Planning Institute of the Nitrogen Industry and Products of Organic Synthesis

[Abstract] Results are presented from kinetic studies of the reaction of n-butanol with chlorohexamethyleneisocyanate (CHI) catalyzed by bis(tributyltin) carbodiimide and tris(tributyltin)isocyanurate. The studies were performed in dioxane and ethylacetate, solvents which have a tendency toward specific solvation and complex formation with the components of the reaction system. In contrast to a spontaneous reaction, the catalytic reaction is not described by a second order kinetic reaction equation, regardless of the nature of the solvent. The decrease in order of the reaction indicates preliminary complex formation of system components with the catalysts. One distinguishing feature of the catalytic reaction performed in ethylacetate is a symmetrical

increase in initial rate with an increase in concentration of alcohol and isocyanate up to the maximum value. A trinary catalyst-alcohol-isocyanate complex is apparently formed. The limiting stage of the catalytic reaction is regrouping of bonds in the trinary complex with the formation of urethane. Figures 3, references 6 (Russian).

[34-6508]

UDC: 541.128:542.91:547.21

#### ACTIVITY OF Co-NITRATE CATALYSTS IN SYNTHESIS OF HYDROCARBONS

Leningrad ZHURNAL PRIKLADNOY KHIMII in Russian Vol 57, No 9, Sep 84 (manuscript received 20 Oct 82) pp 2113-2115

LAPIDUS, A. L., KRYLOVA, A. Yu., KONDRAT'YEV, L. T., ABRAMOVA, T. V., SAVOST'YANOV, A. P. and BAKUN, V. G., Institute of Organic Chemistry imeni N. D. Zelinskii, USSR Academy of Sciences

[Abstract] The purpose of this work was to simplify the method of preparing Co catalysts for synthesis of hydrocarbons from CO and H<sub>2</sub> and to increase the mechanical strength of the catalysts by using the method of saturation of a strong carrier with cobalt nitrate solution. The carrier used was amorphous aluminosilicate type AS-37. The carrier was treated with steam at a pressure of 14 atm after heating in air at 450°C for 5 hours. The carriers were then saturated with a 50% solution of cobalt nitrate at 70°C for 30 minutes, after which the solution was poured off, the catalysts were dried at 250°C for 3 hours. The cycle was repeated to produce catalysts with over 15% cobalt content. The catalysts were reduced at 360°C by passing hydrogen through at a space velocity of 100 hr<sup>-1</sup> for 4 hours. Synthesis of hydrocarbons was performed over a period of 6 to 7 days, each day increasing the temperature by 5°C. The catalysts were found to be effective in the synthesis of hydrocarbons. The yield of liquid hydrocarbons reached 25-54 g/m<sup>3</sup> stp. The influence of steam treatment and of cobalt concentration on activity was studied, and the greatest yield of liquid hydrocarbons was achieved for the catalysts with 28% Co after steam treatment of the carrier for 164 hours. Figure 1, references: 3 Russian.

[34-6508]

## CHEMICAL INDUSTRY

### CURRENT PLANS FOR DEVELOPMENT OF CHEMICAL INDUSTRY

Moscow PLANOVOYE KHOZYAYSTVO in Russian No 9, Sep 84 pp 15-26

[Article by V. Listov, minister of chemical industry: "Planning the Development of the Sector at the Modern Stage"]

[Text] Today the Soviet people are laboring selflessly to bring to life the decisions of the 26th CPSU Congress and subsequent plenums of the CPSU Central Committee. The February and April 1984 plenums of the Central Committee confirmed again the continuity of the party's policies in the field of internal and international life, and policies aimed at further accelerating the economic and social development of our society and creating the conditions which will make it possible to solve within short periods of time the most important task--significantly raising the level of the people's well-being.

The CPSU Central Committee General Secretary and USSR Supreme Soviet Presidium Chairman K. U. Chernenko said that in order to resolve the tasks facing our country today, "we need highly productive labor, and the economic interest of each person in the development of production. Only on this basis can we raise the people's well-being."<sup>1</sup>

An important place in intensifying social production and ensuring higher final results with minimal outlays of material, labor, and financial resources belongs to chemical industry, one of the industrial sectors which determines the scale and rate of scientific-technical progress in the economy.

Chemistry's impact on raising the effectiveness of social production is primarily the result of advances in the field of synthesizing chemical materials. The widespread use of these, as well as methods of chemical technology, is making it possible to realize important social-economic goals of social development with lower outlays of resources. Above all, this means increased production, expanded selection, and better quality of food products, clothing, footwear, and other consumer goods, and improved conditions of medical, cultural, and consumer service of the population. The use of chemical methods leads to a substantially increased level of the utilization, purification, and processing of wastes of industrial production.

Chemization is the necessary condition for intensifying material production and raising its effectiveness, successfully resolving tasks in the field of



improving the manufacture and creation of new equipment and technology, and saving ferrous and non-ferrous metals, wood, leather, and other natural materials. Thus, by broad chemical-energetic use of coal, integrated processing of oil, and the use of chemical materials which are less energy-intensive than natural ones, it is possible to economize on energy resources. Effective protection of metals and wood is impossible without polymer, paint and varnish, and other coverings. As a result of using chemical products and processes in sectors of industry, construction, agriculture, and the sphere of public and consumer services, we are achieving a savings of labor which substantially exceeds its expenditures on the production of goods in the chemical industry.

Bearing in mind the role of the chemical industry in developing the economy, the party and government are constantly manifesting interest in questions of accelerating its development, which has made it possible to create a mighty scientific-technical and production potential, capable of handling large-scale tasks. In recent five-year periods, the chemical industry has turned into a modern, leading sector. Thanks to the advancing rates of development, the specific weight of chemical goods in the total volume of industrial production came up from 5.4 percent in 1970 to 6.8 percent today. During this, the production of plastics and synthetic resins grew by a factor of 4.6, the output of chemical fibers and threads by a factor of 3, and synthetic detergents and other chemical goods by a factor of 7.5. The fixed production capacity of the sector has increased significantly, and its system of working facilities has been joined by major enterprises such as Prikumsk and Shevchenkovo Plastic Plants, Tomsk Chemical Plant, the Sibvolokno Artificial Fiber Plant, and many others.

But in recent years there have been certain difficulties in the development of the chemical industry, which has led in the first two years of this five-year period to decreased rates of growth of volumes of production, labor productivity, and effectiveness. There were a number of reasons for this, including the lag in capital construction, delayed start-up of production capacities, inadequate level of development of chemical machine-building, lax production discipline, and shortcomings in the selection of cadres.

To eliminate these shortcomings, the Ministry of Chemical Industry took a number of measures, and last year was a turning point for the sector; the plan was fulfilled in all technical-economic indicators, and the total volume of production rose by 5.5 percent; moreover, over 96 percent of the increase was due to the growth of labor productivity.

One of the determining factors of successful work is the balance of yearly and long-range plans, and a completely balanced coordination of the production plan with resources. The December 1983 Plenum of the CPSU Central Committee noted that the vast capacities created recently in a number of sectors, including the chemical industry, have for a long time been under-used because of intra-sector and inter-sector imbalances. The disjunctions and disproportions apply most of all to material balances, which play a central role in determining the targets for the output of goods.

The ministry has still not achieved a balance of all sections of plans. The targets established for 1981-1985 for production of many types of output were not fully supported by supplies, raw-materials, and fuel-energy resources, and the targets for start-up of production capacities were not possible given the limits on construction-installation work. Furthermore, breaks in the deliveries of raw materials (cellulose, benzene, higher alcohols, acetaldehyde, vegetable oils, butanol, tin plate, coke, and synthetic fatty acids) led to a worsening of discrepancies and created a strained situation in many production collectives. The discrepancies which arise could be compensated for with reserves of raw materials, supplies, and production capacities, whose creation was planned by the CPSU Central Committee and USSR Council of Ministers decree of 12 July 1979. But so far the industry does not command such reserves.

The sector has done definite work to improve the balance of plans, in particular by the widespread use of economic-mathematical methods and computer technology to form single-product and distribution balances. This has made it possible to some extent to ensure fuller loads of capacities and increase satisfaction of the economy's need for chemical products.

A substantial imbalance in planned targets is caused by delays in start-up of production capacities due to the unsatisfactory progress of capital construction, since the drafting and confirmation of the plans count on output from capacities subject to start-up in the previous year. Such was the case with the capacities for producing methanol in the Tomsk Chemical Plant, polyvinylchloride in Zima Chemical Plant, low-pressure polyethylene in the Kazan Organicheskiy Sintez Production Association, and so forth. As a result--disruption of the production plans of cable plastic compound, formalin, tubes and parts made from thermoplastics, and a number of other products. It is necessary to significantly raise the responsibility for timely start-up of production capacities and fixed capital. Moreover, this responsibility must be two-sided: that of the client for ensuring the full volume of quality technical documentation and equipment, and that of the contractor for carrying the work to completion within the time established by the plan.

The Ministry of Chemical Industry is carrying out constant work to stabilize planned targets. Important directions are improving the organization of material-technical supplies and changing enterprises over to direct, long-term economic ties. The conversion to the products list disseminated by the ministry is completely finished. Now similar work is going on for products distributed by All-Union Production Associations. One of the main things holding back the conversion of enterprises to direct long-term economic ties is the unsteady work of a number of enterprises (suppliers of raw materials), making it necessary to re-shuffle resources, which leads to disruption of the established ties.

There is an advanced form of supplying Production Associations (enterprises) and organizations with material resources: guaranteed integrated provisioning on the basis of contracts which they have made with organs of the USSR Gossnab. This form of provisioning is intended to reduce storage area in enterprises, lower the number of workers engaged in material-technical provisioning, and get raw materials delivered according to agreed schedules.

The Ministry of Chemical Industry gave the USSR Gosnab its agreement for organization of integrated guaranteed provisioning of 20 enterprises, but practical realization of this form of provisioning has still not been achieved.

In order to strengthen plan discipline and increase the stability of plans it is necessary to raise the responsibility of planning and supplies-sales organs of all levels for balanced and well-founded plans. In our opinion, it would be worthwhile for output, which should be obtained from capacities being started up in the planned year, not to be included in total volume in balances of distribution, but rather part of it be directed into the reserves of the USSR Council of Ministers. This would stabilize plans of production and material-technical provisioning, create needed material reserves, and sharply reduce the number of changes made to plans in the course of the year. In connection with the fact that more than half of the output produced by enterprises of the Ministry of Chemical Industry is used within the sector, in drafting the plan of production of important types of output, the ministry should confirm only the part intended for realization outside the sector.

An important role in the sector in improving the economic mechanism is played by the search for ways and methods aimed at increasing the level of use of production capacities of both existing and newly-started enterprises. Basic directions of resolving this problem might be:

basing optimal coefficients of use of capacities on each subsector. In doing this, for each percentage point of increase of this coefficient in the plan, the enterprise should be given additional capital for the fund of material incentives (FMI) by special normative; for a lower coefficient, the FMI will be reduced. Bonuses must be produced within the means of the FMI established for the All-Union Production Association;

enterprises' establishing plans for production volume expressed in actual and cost terms on the basis of technical-economic estimates, taking into account the confirmed coefficients of use of production capacities and the necessary coordination of them with the provisioning of raw materials and supplies.

The development of the sector is being greatly held back by the discrepancy in the development of the chemical industry and chemical machine-building. The now-undertaken direction of reconstruction and technical re-outfitting, and the need to support operating capacities require a significant increase in deliveries of equipment not only for new construction but also to a great extent for repair-running needs, which are being met less than halfway at the present. To resolve this question, it is necessary to expand significantly the enterprises of the Ministry of Chemical and Petroleum Machine Building, which, in our opinion, should be reflected in the plan being drafted for the economy for the 12th five-year period. This applies to large-series equipment. For increasing the production of small-series equipment and spare parts, the plan should envision the creation of a number of enterprises directly in the Ministry of Chemical Industry.

In discussing the problems of development of the chemical industry, it is impossible to avoid the question of the raw materials base. A positive



solution has still not been found for the major problems of supplying the chemical industry with certain types of raw-materials resources: mining and processing titanium-containing and apatite-nepheline ores, the development of the by-product coke industry, and so forth. Eliminating the discrepancies in the development of the chemical industry and the sectors supplying it would significantly increase the output of products necessary to the economy. These issues were reflected in the proposals of the Ministry of Chemical Industry for drafting the Goal-Oriented Integrated Program of Chemization of the Economy. We hope that the USSR Gosplan and sectorial ministries take into account the necessity of resolving these questions in drafting the plan for 1986-1990.

Apart from the incomplete supplying of material resources, the use of capacities is affected by the lengthy time-periods of assimilating new facilities. There are many reasons for this: mistakes in project design and construction, defects in equipment, inadequate level of preparation of cadres in a number of cases, and internal organizational disagreements. To eliminate these factors which are delaying the normal progress of assimilation of capacities, the Ministry of Chemical Industry has created a constantly-operating integrated executive group which systematically examines these questions and develops measures to eliminate bottlenecks and to render effective help to the enterprises. This also has a positive effect on the utilization of the existing production potential.

Questions of improving planning and strengthening the influence of plan indicators on the final results of work require not only changes in this or that indicator, but also organizational restructuring of the actual process of realizing the plan and evaluating its fulfillment. A striking example of this is the strengthening of the role of delivery indicators.

The question of observing contract discipline and fulfilling in a timely fashion targets and obligations for deliveries is especially important in the chemical industry, which is characterized by its extensive list of products turned out and the multitude of inter-sector and intra-sector production connections. Even a negligible failure to observe contract obligations leads to disruption of the balance in the sector and the economy, incomplete utilization of the production potential which has been created, the appearance of stoppages and discrepancies, and lower rates of growth of labor productivity and other indicators of the effectiveness of production. In connection with this, the sector is carrying out a great deal of work to improve the application of this indicator.

The use of the indicator of realized volume with deliveries taken into account has led, as experience testifies, to improved work in observing contract discipline, which is reflected in the decreased number of enterprises and associations of the chemical industry which failed to fulfill targets for deliveries, from 48.2 percent in 1982 to 36.1 percent in 1983. But the practice of being oriented in fulfillment of the plan primarily according to total volume of production and realized output is not obsolete. As a result, enterprises and associations of the Ministry of Chemical Industry in 1983 fulfilled the plan for total volume realized by 101.3 percent, and by 95.6 percent with deliveries taken into account. In the future too, the



ministry will take measures directed at unconditional observance of contract discipline. At the same time, analysis shows that, in 1982 and 1983, more than 50 percent of the cases of failure to fulfill this indicator were connected with outside causes, above all, difficulties of material and technical provisioning.

Currently, in planning the development of the chemical industry great attention is being devoted to the development of facilities to ensure the resolution of the important social-economic tasks laid out in the Food Program, Energy Program, and a number of other goal-oriented integrated programs. These questions were reflected also in the drawing up of the Basic Directions of Development of the sector for 1986-1990 and for the period up to 2000, and in the developed draft of the Goal-Oriented Integrated Program of Chemization of the Economy.

An important place in realizing the Food Program belongs to supplying sectors of the agroindustrial complex with chemical products. Currently, enterprises of the Ministry of Chemical Industry are supplying agriculture with more than 200 designations of products, including polyethylene film, tubes, hay-baling twine, chemical plant protection agents, mineral fertilizers, and feed preservatives. Greenhouses and hotbeds, irrigation systems and pipes, light watering hoses, and finally, packing materials for the food, fish, meat and dairy, and fruit and vegetable industries--none of this would be possible without polymers. For example, in sausage production, a polymer casing is used today. This has made it possible to use highly productive technology instead of manual labor, and lower the labor intensiveness of sausage manufacture by 54 percent. According to the data of the USSR Ministry of Meat and Dairy Industry alone, the economic effect of using 1 ton of film for packing amounts to 17,000 rubles.

A special role in raising the level of automotive and agricultural technology is played by the use of plastics and synthetic resins. It makes it possible to significantly decrease the mass of vehicles, reduce the labor intensiveness of manufacturing complex parts and the aggregate as a whole, and also its servicing, save ferrous and non-ferrous metals, reduce losses from corrosion in non-garage storage of the vehicles, and increase the reliability and work life of units and parts.

A great role in realizing the Food Program is played not only by chemical materials but also by the delicate chemical technologies--membrane and catalyst technologies. The use of membranes in the food industry is increasing the output of soft cheeses by 8-10 percent, and cottage cheese by 15-20 percent. Using semi-permeable membranes it is possible, comparatively easily, to create the necessary gaseous environment for storing fruits and vegetables, which makes it practical to preserve their freshness until the next harvest.

The sector is also doing a great deal to resolve the targets of the Energy Program. It is well known that the first stage of its realization calls for creating the material-technical base for widespread use of non-traditional sources of energy, and also, resolving basic scientific and technical

problems in the field of producing synthetic liquid motor fuels from gas, coal, and oil shale. In this effort, the production of methanol has great significance (it can be obtained from practically all types of fossil fuel). Just five years ago, methanol was regarded as a product for chemical processing. Today it has begun to be used as a direct additive to gasoline. In addition, in order to successfully realize the fuel-energy program, plans call for expanding the production of ion-exchange resins by more than five-fold.

The shortage of tubes remains a no less important question of the development of the economy. These reasons make it necessary to accelerate development of the production of tubes with polymer anti-corrosive coverings, and tubes made from modern polymer materials. Research done in the Plastik Scientific-Production Association has demonstrated the technical feasibility of replacing 30 percent of the metal tubes used today in various sectors of industry and agriculture. The Ministry of Chemical Industry plans to significantly increase the output of polymer tubes, which will make it possible to save millions of tons of steel and cast iron, and equivalent fuel.

Intensification of production is the basic direction of development of the sector. In preparing the draft of the plan for the 12th five-year period, growth is envisioned for the volume of work in technical re-outfitting and reconstruction of existing enterprises, which will not only make it possible to increase the output with lower capital expenses, but also, no less important, improve all technical-economic indicators of the work of the chemical industry and raise the effectiveness of use of the allocated resources.

Under modern conditions, one important way of raising the effectiveness of production and intensifying it is economizing on labor resources. Work by the Shchekino method is fully resolving this task.

Currently almost all enterprises in the chemical industry are working according to the experience of the Shchekino Azot Production Association. During the 10th Five-Year Plan, the sector released about 20,000 persons, as opposed to the 17,100 pledged.

In the 11th Five-Year Plan, the Ministry of Chemical Industry is conducting work to further spread the Shchekino method, taking into account its development and effective use by leading enterprises. The work experience of the Polimir Production Association imeni 50-letiya Belorusskoy SSR is a continuation of the Shchekino method. Instead of the zonal-aggregate method, the complex-technological method of servicing equipment was adopted here. In this method, individual servicing of personally assigned zones was replaced by collective servicing of the entire technological process. The conditions were created for uniting workers into brigades in which each commanded mixed professions, went through studies in specialized courses, and was cleared for independent work on all apparatus and aggregates of the technological division. As a result of adopting the new form of labor organization, labor productivity increased by 30-35 percent in the main shops of the association, and the number of service personnel decreased by 25-30 percent.

The Kaluga Khlorvinil Production Association imeni 60-letiya Velikoy Oktyabr'skoy sotsialisticheskoy revolyutsii has adopted an integrated system of improving production, and organizing of labor, planning, and material incentives. In this system, elements of the Shchekino method are elevated to the rank of standards obligatory for all subdivisions of the association. The use of standards has had a positive effect on activating work in the shops for finding reserves of growth of labor productivity and fulfilling the established volume of work with fewer personnel. As a result, labor productivity rose by a factor greater than 1.5 in the 10th five-year period, freeing 657 workers.

The effectiveness of work according to the Shchekino method is further explained by the fact that it increases the incentive role of basic wages. The experience of enterprises working by this method shows that it is worthwhile to spend the saving of the wage fund not only on increasing piecework payment and prizes, but especially for establishing additional pay for tariff rates and salaries, since fulfilling the set volume of work with a lower number of personnel requires constant effort.

Adopting the Shchekino and other methods of work to accelerate the growth of labor productivity and free personnel from existing enterprises by implementing measures to combine professions, expand the zone of servicing, and fulfill the set volume of work with fewer personnel is the main source for providing qualified cadres to newly started production projects. But on the strength of these measures alone, meeting the sector's demand for the labor resources necessary to accelerate the development of facilities yielding a substantial savings of labor resources in the economy is not possible today. This situation must be kept in mind by the USSR Gosplan in developing prepared and future plans.

An important reserve for accelerating, as well, the increasing growth of labor productivity in comparison with the growth of wages, one which can be used in all enterprises of the sector, is widespread adoption of the brigade form of organization and payment of labor. Creating and correctly organizing brigades makes it possible to substantially improve the production and technical-economic indicators of work, strengthen labor and production discipline, and raise the sense of collectivism and responsibility for the final result.

The chemical industry has accumulated positive experience of using this advanced form of labor organization and payment. The sector has created a total of 27,000 brigades, of which 9784 are integrated (36 percent of the total number of brigades), having 121,800 workers (45 percent), including 888 all-round brigades (3.3 percent) having 17,800 workers (6.6 percent). According to final results of labor, extra wages were paid in 9737 brigades (35.8 percent) with a total of 103,400 individuals. Taking into account the labor participation coefficient, bonuses were distributed in 6825 brigades with a total of 78,400 individuals, or 29.2 percent.

The chemical industry, because of its structure and economic features, belong to the sectors which have a high raw-materials index and high energy



intensiveness. Thus, in the prime cost of chemical production, the share of material expenses is more than 72 percent, and the sector's share of consumption of energy resources amounts to 2.6 percent of the electrical energy and 3.6 percent of the thermal energy used in the economy as a whole. The importance of the problem of reducing the materials intensiveness of chemical production is attested by the fact that reducing material expenses in the sector by just 1 percent would provide a savings of about 100 million rubles.

The problem of all-around savings of raw-materials and energy resources in the sector acquires particular urgency in light of the tasks set by the December 1983 Plenum of the CPSU Central Committee to lower the prime cost of production by 0.5 percent more than planned. These are the basic directions of resolving this task in the chemical industry:

adopting new, advanced technological processes which make it possible to significantly lower or completely eliminate the expenditure of certain raw-materials and fuel-energy resources;

using effective catalysts, adopting regeneration capacities, and replacing periodic processes with continuous ones in order to reduce wastes and losses;

lowering norms of expenditure of raw materials and supplies, especially certain scarce types of raw materials in chemical fiber production and chemico-photographic industry, and a number of other measures calculated to save raw materials by raising their quality and using secondary resources, lowering losses of fuel and petroleum products, and also fuel and electrical energy.

One of the leading directions of improving the economy of the sector is augmenting the work to ~~save~~ and make rational use of material and fuel-energy resources. Today it is impossible to approach economizing only by lowering norms. Substantial savings are being provided by fundamentally new technological processes. Among these are the adoption of synthetic film-forming substances in the paint and varnish industry, which makes it possible to save more than 100,000 tons of vegetable oils; converting the production of chemico-photographic materials with a black and white image to color, and organizing centralized assembly of the materials used, which provides for saving silver; and raising the physical-mechanical indicators of polymer films and synthetic fibers. This makes it possible to save tens of thousands of tons of polymer materials.

The adoption of highly effective technological processes based on the use of equipment with large unit capacity has great significance in the development of the chemical industry. Thus, in 1980 the volume of production of low-density polyethylene in aggregates with a capacity greater than 50,000 tons per year amounted to more than 47 percent of the total volume of its production, and by the end of this five-year period it will reach 58 percent. The proportion of polyvinylchloride produced in facilities with capacity of 50,000 tons per year or higher is scheduled to reach up to 35 percent in 1985, and so forth.



The adoption of aggregates of large-unit-capacity is accompanied by expanded application of automated systems of control of technological processes, which affects the nature of labor--it raises the number of engineering and technical workers involved in fulfilling organizational-technical functions directly in production facilities, as well as the level of qualification of the workers.

As a result, not only is there growth in the effectiveness of chemical production facilities, but social problems are resolved as well. Under these conditions, in our view, the USSR Central Statistical Administration and USSR Ministry of Finance should re-examine the nomenklatura of personnel who make up the staff of the administrative apparatus, since the existing classification is leading to the relative growth of this category and formalistic increasing of expenses for administration.

One of the important measures in resolving the task of accelerating scientific-technical progress is the all-around development and improvement of organizational forms of linking science to production, especially a form such as the Scientific-Production Association. There are now 18 Scientific-Production Associations functioning in the sector; their share in the overall expenditures for scientific-research and project-design work amounted to 29.9 percent in 1983, while their share in the economic effect of adopting new formulations was 43.2 percent. The length of time from formulation to adoption in them was lower by a factor of 1.3-1.5 than the average throughout the sector. In the next 2-3 years, it is planned to create 17 more new Scientific-Production Associations in 10 subsectors.

But the existing system of planning does not allow for full utilization of the advantages of Scientific-Production Associations in the creation and adoption of new technology. This problem can be solved by creating a unified system of planning, financing, and economic incentives for Scientific-Production Associations. Research carried out in the sector confirms the fundamental possibility of creating such a system.

The June 1983 Plenum of the CPSU Central Committee posed the problem of serious shortcomings in the administration of adopting new technology. The currently-used system of incentives for work with new technology is not having a substantial enough effect on the total size of enterprises' incentives funds, which sharply reduces their interest in increasing the volume of application of new technology. For example, the fraction of funds for work to create and adopt new technology in the overall incentives funds of enterprises of the chemical industry is not higher than an average of 6 percent. So it is necessary to substantiate the principle of constructing such a system of incentives in enterprises, which would make it possible to increase the effect of factors of new technology on the size of their incentives funds. The Ministry of Chemical Industry is doing research in this direction.

The chemical industry has more than 100 scientific organizations and branches of them, and about 50 experimental plants and experimental production facilities. Effective use of such a substantial potential largely depends on its organization. One of the most important conditions is the need for an integrated approach, since, as practice attests, partial improvements of methods

of administration do not produce the desired results. In the integrated system of control of scientific-technical progress being created in the Ministry of Chemical Industry, the main stress is being laid on interdependent improvement of planning, financing, economic incentives, pricing, and methodology of determining the effectiveness of research and developments. The main goal of this work is to orient developers toward raising the feasibility, effectiveness, and scientific-technical level of the work carried out, and toward reducing the time taken to carry it out and accelerating its practical realization.

For almost 10 years, the Ministry of Chemical Industry has been using the principles of program-goal-oriented planning and control of scientific-technical development, which is having a positive effect on the structure of the work carried out (the number of trivial developments has decreased by a factor of nearly 1.4). Innovative in comparison with other sectors is the 1980 adoption of technical-economic substantiation of subjects with the use of patent-technical features of the topics planned, and substantiation of the feasibility of their completion and adoption within a time no greater than 10 years. More precisely substantiating topics, linking them to plans of capital construction, and enlarging them into integrated problems has made it possible to reduce the total number of work orders to 2,700 units with a planned volume of financing of 69 million rubles. The funds saved are put into fulfilling other goal-oriented integrated scientific-technical programs. In order to accelerate the use of developments of the Academy of Sciences of the USSR and the union republics, and VUZes, as well as involving these organizations in solving the problems of development of the sector, the Ministry of Chemical Industry created in 1980 a system for inter-departmental planning of joint scientific-research projects and adopting their results. Now more than 200 joint developments of the USSR Academy of Sciences scientific-research institutes and organizations of the Ministry of Chemical Industry have been adopted, with an expected economic effect of more than 240 million rubles.

A substantial role in resolving tasks of accelerating the development of the chemical industry belongs to capital construction. The chemical industry was the first to convert to new forms of interrelationships of designers, provisioners, clients, and builders in supplying sites with equipment.

Under the conditions of the increased responsibility and expanded rights of enterprises in using capital outlays, a rough layout of the development of a plan of capital construction might be as follows. In the pre-plan stage, an estimate of this section of the plan is made using all forms of reproduction, all directions of use of capital outlays, and the entire selection of indicators (the methods of forming this plan are worked out in the sector). On the basis of this estimate and the determination of optimal reproductive structure of the plan of capital construction, and also taking into account the limitations of resources, volumes of technical re-outfitting and reconstruction of existing enterprises of the sector are established. Taking into account the established normatives of technical re-outfitting and reconstruction, normatives are worked out for the fund of development of production as a whole for the sector and each all-union industrial association, differentiating normatives by enterprise.

Plans of production are confirmed for the sector, All-Union industrial associations, and enterprises, taking into account the completion of work in technical re-outfitting and reconstruction of existing enterprises in volumes envisioned by estimates and supported by sources of financing, including the fund of developing production. No plans for capital outlays in technical re-outfitting and reconstruction of existing enterprises and targets for growth of capacities are made. Only normatives of the fund of developing production and indicators of basic activity are confirmed. Under these conditions, the USSR Stroybank can implement control over the use of monies from the production development fund to achieve goals envisioned by the confirmed plan of production--that is, examine documents of the construction's itemized list, and estimates of effectiveness as well in case of the need to allocate additional credits.

Plans for expanding new construction of existing enterprises are confirmed as before--that is, depending on the limits worked out and confirmed at various levels by the itemized lists. In doing this, the plan of production from new capacities--that is, capacities obtained by new construction and expansion--is made up separately. The responsibility for constructing such projects must belong first to contract organizations. It is worthwhile to transfer them as completely as possible to the system of turning objects over for "turn key" use.

In order to ensure actualization of the suggestions outlined above, the USSR Gosplan must establish limits of contract work even at the pre-plan stage from the point of view of regions of activity of contract construction trusts--that is, in greater detail than now, but without tying them to specific sites. Limiting resources connected with carrying out construction-installation work, the sector will be able to resolve the problem of more optimally distributing construction projects, and handle questions of developing the economic resources in order to carry out work on technical re-outfitting in areas with the greatest restrictions in the indicated limits.

The work experience of the Ministry of Chemical Industry under conditions of the three-link system of administration gives grounds for drawing the conclusion that on the whole it makes possible rational organization of processes of administration of the sector. At the same time, a number of unresolved issues have come up. Above all, it is necessary to note that administration of the sector is complicated by the fact that under modern organization of production, the objective production-technological ties forming the chemical complex and existing within it have become separated in the administrative-economic sense.

Speaking of the middle link of administration, it is necessary to say that, in our day, the All-Union industrial association fulfills the basic functions of an administrative organ of administration. The problem is to turn it into a direct participant in the reproduction process. To do this, it is necessary to assign to the All-Union industrial organization functions of distributing goods, allocate the necessary funds and reserves for it, and transfer it to the normative method of distributing profits. Only in this way can it become an effective administrative link of the subsector and ensure the production of consumer goods.



At today's stage of development, under conditions of the significantly-increased production potential and more complex inter-sector and intra-sector connections, questions of further improving planning and administration are becoming especially urgent. So, great significance attaches to expanding the rights of industrial enterprises and raising their responsibility for the final results of work.

The sector has expanded preparations for carrying out the economic experiment which has been conducted analogously in a number of sectors since the start of 1984.

In order to do this, enterprises of the sector have organized discussion of the basic directions of improving economic activity, consistently fortifying the economic estimate and proposals to strengthen the interest of labor collectives in increasing production and strengthen responsibility for the final results of work at all levels of administration.

As noted at a session of the CPSU Central Committee Politburo, the possibilities created by the new conditions of management demand active restructuring of economic work and improvement of the style and methods of leadership. In their work, the board of the ministry and the central apparatus are being guided by these requirements for successfully setting up and carrying out the experiment. Primarily, this applies to strengthening discipline of deliveries and ensuring the uninterrupted work of factories producing needed parts. Forming the production plan in direct connection with the demands of clients and fully tying it to material, fuel-energy, and labor resources should provide for strengthened plan discipline and expansion of local initiative. But this can only be achieved with an integrated solution of the problem and significantly increased exactingness for all sections of the production cycle. Currently, the partners (industrial enterprises, and construction and transport organizations) are under unequal conditions, since the fines and penalties for violating contract relations are a long way from fully compensating for damages incurred. This is one of the vital questions which must be resolved in carrying out the economic experiment.

In the course of preparations, it is proposed to work out a system which will make it possible to more fully take into account the multitude of subsectors of the chemical industry, since the sector has many profiles and includes, along with the continuous apparatus of technological processes, processes analogous to the machine building, metallurgy, textile, and many other sectors. Naturally, this leaves a noticeable imprint on the development of new conditions of management. Carrying out the experiment will help us cope with the existing difficulties and direct the forces of the sector's workers toward achieving high final results.

Expanding the rights and independence of enterprises should be combined with eliminating duplicated effort and parallelism in the work of different departments. Today, for example, many indicators of plans of enterprises come into local organs (planning and finance organs) both from enterprises and from ministries. Thus, reports on the confirmed wage funds of an enterprise are presented in local organs of the USSR Gosbank, and simultaneously these reports come from ministries and All-Union industrial organizations into the



board of the USSR Gosbank, whence they are sent to local destinations. In our view, this yields nothing but superfluous correspondence. And these examples are not unique. It is necessary to relieve central organs of administration from the petty tutelage of enterprises, grant each level of administration the chance to resolve its own problems which come up in ensuring successful realization of the party's economic policies, further strengthening the economy of our country, and resolving, on this basis, the most important social-economic task--steadily raising the standard of living of the Soviet people.

#### FOOTNOTE

1. K. U. Chernenko. "Narod i partiya ediny. Izbrannyye rechi i stat'i." [The People and the Party United. Collected Speeches and Articles.], Moscow, Politizdat, 1984, p 467.

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## LABORATORY OF ULTRAPURE SUBSTANCES

Moscow TRUD in Russian 27 May 84 p 1

[Article by V. Karpov]

[Text] The outsider is prohibited from entering this laboratory. True, one may observe the work of the employees through glass windows, but one must not go inside. And those who work in this unusual glass cube cannot gain entrance immediately. First, they are arrayed in overalls, treated by a special method, the cleanliness of which is higher than, say, the gown of a surgeon in an operating room. Then, the worker goes to the entrance cubicle, resembling a lock, as if all this were taking place not on earth, but on a space station or spaceship. And it is only via the lock that one may enter the laboratory, where its own microclimate is maintained. The air here undergoes purification of admixtures and is thin, as in the mountains. It is just for this reason the team's working shift lasts no more than four hours.

There are several such laboratories in the Chemical Reagents and Ultrapure Chemical Substances SRI. There they obtain substances of phenomenal, absolutely fantastic purity. We are speaking not only of the structure of the substance, of the absence of chemical admixtures within it, but also of purity in the most direct sense of the word—that is, that the article be ideally clean on the outside.

The first question is why is this necessary?

Such components are necessary, for example, for radioelectronics. Here, let us say, are semiconductors without which today's computers and modern radio equipment would be unthinkable. They collect the semiconductors themselves as if from individual building blocks—microelements. The reliability of the entire system and, we assume, of the computer, depends primarily on the way in which these building blocks fit together.

Here is where the problem begins, and what a problem. Let the finest submicron particle of dust strike the semiconductor during assembly, and it might as well be thrown into the trash. That's how it was about 15 years ago, by the way. The industry produced fewer suitable semiconductor products than waste materials. And one more thing. The more sterile the components, the more they may be distributed on one and the same area. Miniaturization, economy—this is what "pure" production is.

It would seem that nothing could be simpler. One must treat the surface with the usual solutions, with acids, degreasing agents, and the problem is solved. But in practice, it has turned out to be more complicated. The difficulty was that these cleansing agents themselves, alas, were not very pure and contained microscopic admixtures.

No, a genuine super cleansing of the solutions themselves, including the semi-conductors, was required. This was the problem presented to the chemists, and more precisely, to the collective of one of the oldest institutes in our country, the Chemical Reagents and Ultrapure Chemical Substances SRI, opened in 1917 at the instigation of V. I. Lenin.

"Initially, it seemed to us that we would solve this problem rather quickly," said Ye. Ryabenko, institute director. "The more so, since the means was known. It was necessary to use traditional purification methods as a foundation--distillation, crystallization and rectification."

In the beginning, the search was comparatively simple. One after another they created cascades of cleaning compounds which reduced the quantity of admixtures per milliliter, for example, of acid from hundreds and tens of thousands to a few thousand units. But here the misfiring began. However much they increased the line of cleansers, the quantity of admixtures did not decrease. The dust "slipped away" from the scientists. And they themselves were the cause.

It turned out that in order to go further, it was necessary to add not only the purity of the reaction itself, but also of the environment in which it was occurring. It was essential to change the equipment in a radical way. Both it and the person were polluting the substances.

When several hermetic laboratories with an artificial climate were created on the premises of the institute and methods for specially treating clothing were developed, the first success was achieved.

Of course, the story of the scientists' search has been simplified and given schematically. This was very difficult, stressful work. It was not enough to sterilize the environment. The particular pollutants which must be washed from a given substance, as well as the remaining admixtures, also had to be discovered. And the less admixture remaining, the more precise the control instruments which made it possible to look at the substance at the submolecular level must be.

"I will give two small examples," said Ye. Ryabenko. "You know, obviously, how popular the 'Horizon' color televisions are? They have grown in quantity after the factory recently began to use our ultrapurified substances. The image began to be precise, the colors brighter and more saturated. And do you remember how much microcalculators cost several years ago? About 150-200 rubles. Today, they cost about 25-30 rubles. And this was made possible to a large extent by the success in finding the solution to the problems of highly ultrapurified substances. On the whole, in principle, this has opened new possibilities in technology. Take, for example, a metal without impurities.

This is, in fact, a completely new material. Iron after ultrapurification (not external, of course, but chemical) may support, instead of 180, more than 1,000 kilograms per square centimeter. Here you have chemists in the role of metallurgists.

"And take quartz glass, the raw material for laser optics or optical communication systems. The light ray with information encoded in it may traverse a path along not very 'pure' guides several tens of meters. But this may be several kilometers if the guides are purified. In order to "nudge" the information farther, a relay station is necessary. Imagine how many stations are necessary in the first and second cases! Today, thanks to the achievements of chemists, an approach to a practical solution to the problem of creating a fiber optic communications system has succeeded."

Simply fantastic perspectives are revealed on this path--in fact, optical systems don't need conductors. And the capacity and velocity of information transmission is several times higher. One single communications line of this sort may substitute for tens of traditional lines.

And if another step forward is taken and the purification of substances from admixtures continues? Then even more highly miniaturized equipment will emerge.

And new questions arise. How is it possible to deliver the product to the user so that it does not lose its valuable properties? How can the conditions of the institute and the industrial conveyor belt be equalized so that at all stages the substance remains extremely pure? Scientists are working on these problems.

12318

CSO: 1841/11



## FINE ORGANIC SYNTHESIS

Moscow TONKIY ORGANICHESKIY SINTEZ, YEGO ZNACHENIYE, OSOBENNOSTI RAZVITIYA (NOVOYE V ZHIZNI, NAUKE, TEKHNIKE: SERIYA "KHIMIYA") in Russian No 7, Jul 84 pp 2-9, 64

[Annotation, introduction and table of contents from booklet "Fine Organic Synthesis, Its Importance and Features of Its Development" by USSR Academy of Sciences Member Nikolay Konstantinovich Kochetkov, Director of the USSR Academy of Sciences Institute of Organic Chemistry imeni N. D. Zelinskiy, and Galina Vasil'yevna Kondrat'yeva, candidate of chemical sciences and senior scientific associate of the USSR Academy of Sciences Institute of Organic Chemistry imeni N. D. Zelinskiy]

### [Text] Annotation

This booklet deals with one of the most extensive and complex areas in chemical science and industry—fine organic synthesis—whose products are used in an extremely wide variety of fields of the national economy and everyday life.

The publication is intended for lecturers, teachers and students of peoples' universities, teachers and students of institutions of higher learning and technical schools and an extremely broad range of readers.

### Introduction

The development of basic scientific research and the rapid and comprehensive practical use of the achievements of science are the most important factors in accelerating scientific and technical and social progress in modern society.

Chemistry has an important role among the basic sciences, which are of enormous importance for intensifying industry and agriculture, improving public well-being and strengthening the defensive capabilities of the country. Fine organic synthesis, which is one of the most important, most extensive and most complex fields of modern chemical science and industry, has special importance in solving these problems.

The problem of developing fine organic synthesis was reflected in the Basic Directions for Economic and Social Development of the USSR for 1981-1985 and

the period up to 1990, approved by the 26th CPSU Congress. Section IV of the Basic Directions for the Chemical and Petrochemical Industry includes "increasing the output of products of small-scale chemical production. Satisfying more fully the demand of the national economy for chemical additives for polymer materials and the synthesis of drugs, for textile auxiliary substances, preservatives, catalysts, synthetic fibers, threads and dyes, paint and varnish materials and packing materials, detergents, fat substitutes and vegetable oils for technical purposes, specially pure chemical materials and reagents and special extremely thin polymer films." Accomplishment of a number of sections of the USSR Food Program for the period up to 1990 approved by the May (1982) Plenum of the CPSU Central Committee and solution of a number of problems included in nationwide scientific and technical target programs will depend to a considerable degree on the level and intensity of scientific and technical developments and the state of the industry of fine organic synthesis. The products of this branch of the chemical industry, often called products of "small-scale chemistry" (more accurately, products of small-scale chemical plants), are widely used in a wide variety of areas of national economy and daily life. Therefore, this sphere of production determines to a considerable degree both the economic potential of the country and the standard of living of the population.

One can include the following among the most important trends in fine organic synthesis: the synthesis of biologically active compounds for the needs of medicine (pharmacological and chemical therapeutic agents, vitamins, hormones, etc.) and agriculture (pesticides, protective agents and growth regulators for plants, and agents for protecting and stimulating the growth of animals);

synthesis of dyes for various purposes;

synthesis of substances for photographic and other means for recording information;

synthesis of chemical additives for polymer materials (heat and light stabilizers, antioxidants, vulcanization agents and accelerators, blowing agents, etc.);

synthesis of plasticizers for plastics;

synthesis of organic flotation agents;

synthesis of organic inhibitors of metal corrosion;

synthesis of chemical agents and specially pure organic substances, as well as a number of other directions.

The production of physiologically active substances intended for preventing and treating human diseases is one of the most important specializations of fine organic synthesis, directly determining the health and working fitness of the population of the country.

The origin of fine organic synthesis was involved historically with the creation of the first synthetic drugs. Now the production of medicinal

preparations for preventing and treating various diseases and for maintaining functions of a healthy person at the level needed is an enormous industry in regard to the assortment of products, covering the production of practically all classes of organic compounds. The importance of the availability of a wide assortment of means for direct treatment and prevention of diseases is quite obvious. Great importance has been placed recently on finding means for improving the natural immunity to infectious diseases, means for preventing viral diseases, special blood substitutes, drugs with prolonged effects, etc.

In addition to using fertilizers and various techniques of agrotechnology for producing high and stable crop yields and reducing losses, it is necessary to take special measures to protect plants against diseases, pests and weeds, from which mankind loses about 50% of the harvest of farm crops annually. Pests cause an enormous loss to animal husbandry. For this reason, one of the main measures for improving the efficiency of agriculture is the use of pesticides. This general term covers chemical substances used for fighting plant diseases and pests and weeds as well as means for protecting animals against parasites. The category also includes compounds for regulating plant growth and other products for chemization of agriculture, with the exception of fertilizers.

The creation of new and highly effective pesticides is also of primary importance for a number of other industries of the national economy which use agricultural raw materials and is one of the most important trends in fine organic synthesis.

A characteristic feature of products of the industry of fine organic synthesis is that, on a small scale, they provide a large economic effect in improving the quality of the main products. For example, the very existence of the production of textile materials, clothing, furs, printing, furniture, paint and varnish, construction and finishing materials, etc., is unthinkable now without synthetic dyes. Although organic dyes go into the product being dyed in very small amounts (from hundredths of a percent to several percent), their importance in qualitative evaluation of the material is very great, since the color creates the first and quickest impression and even proves decisive in a number of cases.

Processing most polymer materials is impossible at present without the use of special additives. Chemical additives introduced into the polymer in small quantities (fractions of a percent of the polymer weight) make it possible to multiply the intensity of treatment processes and to improve the working properties of the polymers themselves and of products based on them. The large and economically important industry of fine organic synthesis includes the production of stabilizers, antioxidants and other means for preventing aging of polymer materials, plasticizers of various types, additives for vulcanizing rubbers, etc.

It is well known that injecting additives into lubricant oils can increase the service life of the lubricant materials by 40-50%. The main characteristics of modern means for recording information, especially movie photographic materials, such as light sensitivity and spectral resolution, color



transmission, image brightness and stability, etc., are determined to a crucial degree by products of fine organic synthesis used in producing these materials.

The examples cited, the list of which could be continued, show the role and importance of products of fine organic synthesis in the creation of materials for new technology and the development of many modern branches of industry and of the national economy as a whole.

Despite the extreme variety in the uses of products of "small-scale chemistry" in the economy, fine organic synthesis should rightfully be considered as a single scientific and technical problem, since the entire field is based on the development of a single science--organic chemistry--and the corresponding branch of chemical technology. In addition, it should be emphasized in particular that fine organic synthesis has a direct effect on the development of biochemistry, molecular biology and other sciences of a biological character involved with knowledge of processes of vital activity and with the creation of biotechnology.

This becomes clear in considering the history of the establishment of these disciplines. It was involved directly with the discovery of the structure and accomplishment of the synthesis of proteins, nucleic acids and their fragments, a number of analogs and inhibitors of enzymes and many other achievements in these fields of science based on the use of principles and methods of organic chemistry. On the other hand, the development of the bases of biotechnology and, in particular, the principles of genetic engineering is indissolubly linked to methods for isolating and purifying products produced biologically and to synthesis and modification of source substances for these processes, also based on the use of principles of organic chemistry and the corresponding branches of chemical technology. Fine organic synthesis, as a part of organic chemistry, represents the main content of this science in an experimental regard. The laws of organic chemistry, the richness of its synthetic possibilities and investigation methods and the study of mechanisms of reactions and the structures of substances make up the foundation on which fine organic synthesis develops.

The creation of the scientific bases for fine organic synthesis is built up from the development of two closely related basic scientific trends. One of them consists of development of general scientific bases of synthetic organic chemistry, which includes finding new reactions and studying their mechanisms, creating new methods for synthesis and new physicochemical methods for analyzing organic compounds and developing the overall strategy and methodology of complex synthesis and ways leading to one promising class of organic compounds or another.

The other trend, which starts from the direct needs of the appropriate branch of industry which uses the products of fine organic synthesis, combines discovery and selection of compounds with the most suitable specific properties, development of the most efficiency systems for producing them and creation of technology useful for industry.



Fine organic synthesis appeared historically quite a long time ago. Friedrich Wöhler synthesized urea--the first natural organic substance produced by chemists in the laboratory--in 1828. In 1856 William Perkin produced the first synthetic dye, and at the end of the last century Emil Fischer and other German chemists produced the first synthetic drugs. Thus, commercial fine organic synthesis was born primarily out of the practical needs of the dye and drug industries. Later it developed rapidly, and at present it is an extensive field of knowledge and an enormous, very complex branch of the chemical industry.

The development of organic chemistry and fine organic synthesis in the USSR, closely involved with overall successes of the chemical sciences, was defined above all by the requirements for economic development of our country.

Domestic organic chemistry has rested on glorious traditions developed long ago and established by works of remarkable Russian organic chemists N. N. Zinin, A. M. Butlerov, A. M. Zaytsev, V. V. Markovnikov, Ye. Ye. Vagner, G. G. Gustavson, N. A. Menshutkin, M. I. Konovalov and S. N. Reformatskiy, among others.

Such outstanding scientists as N. D. Zelinskiy, A. Ye. Favorskiy, A. Ye. Chichibabin, L. A. Chugayev, S. V. Lebedev, P. P. Shorygin, N. M. Kizhner, N. Ya. Dem'yanov, A. N. Nesmeyanov, S. S. Nametkin, A. Ye. Arbuzov, A. P. Orekhov and I. N. Nazarov made an inestimable contribution to the development of organic chemistry. These chemists trained a galaxy of outstanding scientists who created schools of modern organic chemistry which have occupied a worthy place in world science. All the most important specializations of organic chemistry and organic synthesis are represented at present in the USSR to one degree or another.

The industry of fine organic synthesis in this country actually was recreated after the Great October Socialist Revolution. Only a few small plants and works organized before the revolution by foreign firms were reconstructed and redesigned in the twenties. As early as the first five-year plans, however, strong foundations were created for the development of the industry of fine organic synthesis, especially for industrial production of dyes and drugs, and large-scale enterprises were built for producing the main intermediate products and finished products for the appropriate purposes. The gradual expansion of the character of these enterprises made it possible to supply rapidly developing domestic industry with many other products of fine organic synthesis as well--movie photographic materials, chemical additives for polymer materials and basic intermediate products. All this played an enormous role during the Great Patriotic War, when it was necessary to supply the army and the population with everything they needed, and this was done.

The modern industry of fine organic synthesis in this country produces the main compounds and materials necessary for the development of the national economy and for satisfying the needs of the population: drugs, vitamins, hormones, chemical means for protecting plants, plant and animal growth regulators, dyes, movie photographic materials, auxiliary substances for the polymer, textile and other types of industry and a number of materials for a wide variety of areas of new technology. However, the rapidly growing

demands of the national economy and of our people are posing more and more new problems, whose solution requires further development of basic research, continuous and intensive searching for new substances of practical value and the creation of modern technological methods for their production for providing constant and rapid progress in the development of the industry of fine organic synthesis.

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12742

CSO: 1841/361

#### BRIEF

LEADING FERTILIZER PRODUCER--The Yefremov Chemical Plant turned out the millionth ton of sulfuric acid. The enterprise has confidently come out at the level of the Five-Year Plan's control quotas. Over two years the plant has become one of the leading producers of liquid complex fertilizer in the nation. Chemists are also fulfilling the additional requirements for the growth of labor production and cost decreasing. In preparation for a worthy reception of the 67th anniversary of Great October, they have exceeded the production plan by 6.4 million rubles. "The successful development of capacities by Yefremovites is a natural result," says Head of the Tula Party Obkom Department of Metallurgical and Chemical Industry V. Semenov. "The constructing plant's board of directors has shown an exceptional fastidiousness toward the level of project documentation and has led an uncompromising struggle for quality in constructional, installational and adjustment work." The right-flank of the socialist competition for the pre-October work watch are mechanical operators N. Kuznetsov and A. Krasnova and foreperson E. Minenkova. [E. Mokhorov] [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 4 Nov 84 p 1] 12614

UDC 662.749.363.6

**ANALYSIS OF LIGHT PYRIDINE BASES PRODUCTION STATE IN COKE-CHEMICAL PLANTS  
OF RSFSR AND KAZAKHSTAN**

Moscow KOKS I KHIMIYA in Russian No 10, Oct 84 pp 35-37

SHASHMURINA, L. A. and EKGAUZ, V. I., VUKHIN [Eastern Scientific Research  
Institute of Coal Chemistry]

[Abstract] Coke-chemical industry is the only source of light pyridine bases (LPB). In recent years their production fell behind demand, at some plants as much as 25-35% below the theoretically-calculated levels. Analysis of the possible losses of LPB showed that 40% are lost with the coke gas due to the elevation of the temperature (with temperature being maintained at 65°C or below these losses should not exceed 20% of the resources). The final concentration of LPB in water, after passage through the column, is 0.15-0.20 g/l and it is directly related to the physical-chemical condition of the system. It could be lowered through considerable consumption of steam. LPB losses connected to the effluents amount to 10% of the available resources. Considering all possible losses, the production of LPB should reach a 55-65% level of the available starting resources. Figures 3.

[38-7813]



## COAL GASIFICATION

UDC 662.749.2:662.6:543.878+536.662

### RELATIONSHIP BETWEEN COKE REACTIVITY AND HEAT OF ITS REACTION WITH OXYGEN

Moscow KOKS I KHIMIYA in Russian No 9, Sep 84 pp 19-21

IGNASHIN, V. P., POKROVSKAYA, T.P., POPOV, V.K. and RUS'YANOVA, N. D.,  
Eastern Scientific Research Institute of Coal Chemistry

[Abstract] Differential scanning calorimetry was employed in assessing the correlation between the heat capacity of coke and its chemical reactivity. Actual studies of reactivity with oxygen in argon/oxygen mixtures (25% v/v O<sub>2</sub>) at temperatures approaching 350°C demonstrated that the heat of reaction could be correlated with coke reactivity determined from reduction of carbon dioxide. In view of the fact that the exothermic effects of coke-oxygen reaction correlate with standard methods of assessing coke reactivity (GOST 10089-73), the latter can be used with considerable confidence in preliminary coke analysis at low temperatures. Figures 3; references 8: 5 Russian, 3 Western.  
[20-12172]

UDC 662.749.33:66.048.37

### COMMERCIAL DISTILLATION OF LOW SULFUR COAL TAR

Moscow KOKS I KHIMIYA in Russian No 9, Sep 84 pp 27-28

GOGOLEVA, T. Ya., UKhIN [Scientific Research Institute of Coal Chemistry?]  
and KOVALEV, A.P., Novolipetsk Metallurgical Combine

[Abstract] Experimental studies on distillation of low sulfur coal tar (0.26% thionaphthene) demonstrated that reduction of thionaphthene in the tar results in its concentration in the naphthalene fraction during rectification. This is due to the closeness of the boiling points of naphthalene (218°C) and thionaphthene (220°C), and the formation of an azeotropic mixture with naphthalene. Approximately 78% of the thionaphthene becomes concentrated in the naphthalene fraction, 6.0% enters the anthracene fraction, 4.4% the phenolic fraction, and 11.9% the wash oil. References 3 footnotes: 2 Russian, 1 Western.  
[20-12172]

## ANALYSIS OF RAW PHENOL PRODUCTION AT COAL TAR CHEMICAL ENTERPRISES IN RSFSR AND KAZAKHSTAN

Moscow KOKS I KHIMIYA in Russian No 9, Sep 84 pp 29-31

SHASHMURINA, L.A., PISTROVA, P.D. and CHEVTAYEVA, L.A., Eastern Scientific Research Institute of Coal Chemistry

[Abstract] An analysis of the statistics on the production of phenols and cresols in the RSFSR and Kazakhstan has shown that in the period covering 1975-1981 the production of these products has fallen by approximately 5%, although the source materials have increased by 2.8%. This has been due largely to both incomplete extraction and incomplete processing of the starting raw materials. The importance of phenols and cresols in the national economy demands that new technological processes be developed and implemented to increase the efficiency of extraction, and that the capacities of such plants be expanded accordingly. In addition, steps should be taken to extract phenols and cresols from fractions other than the carbolic fraction obtained from coal tar distillation, in order to utilize the available resources to the fullest. Figures 2.

[20-12172]

UDC: 552.57

## CHEMISM OF FORMATION AND PROPERTIES OF SAPROPELITE COAL, PART 1: STUDY OF TAYMYLYRSKIY BOGHEAD

Novosibirsk IZVESTIYA SIBIRSKOGO OTDELENIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKIKH NAUK in Russian No 11 (386), Jul 84 (manuscript received 5 Dec 83) pp 121-127

BODOYEV, N. V., KOPTYUG, V. A., LEBEDEV, K. S., KASHIRTSEV, V. A. and FRADKIN, G. S., Novosibirsk Institute of Organic Chemistry, Siberian Department, USSR Academy of Sciences; Institute of Geology, Yakutsk Branch, Siberian Department, USSR Academy of Sciences

[Abstract] The Taymylyrskiy boghead consists primarily of alginite with small quantities of vitrinite. The samples studied in this article had an ash content of 3.2% and the following fuel mass composition, %: C 76.4; H 9.2; N 0.6; O 9.9; S < 0.3. The oxygen content is higher than previously studied boghead samples. The results of the chemical analysis confirm that bogheads are primarily products of polymerization of straight-chain unsaturated fatty acids with some double bonds. The basis of the three-dimensional polymer structure is apparently a polycyclic hydrocarbon matrix consisting of  $\text{CH}_2$  and  $\text{CH}$  fragments with the attachment of N alkane chains with  $\text{CH}_3$ - and  $\text{COOH}$  groups at the ends. Hydrogen bonds with  $\text{COOH}$  groups additionally increase the hardness of the boghead structure. The presence of small quantities of aromatic fragments probably results from cyclization

during the course of formation of unsaturated fatty acids with subsequent dehydrogenation as well as the presence of vitrinite. Figures 5; references 16: 9 Russian, 7 Western.  
[388-6508]

UDC: 661.666.2

#### ARTIFICIAL GRAPHITE, PRODUCTION AND PROPERTIES

Leningrad ZHURNAL PRIKLADNOY KHIMII in Russian Vol 57, No 9, Sep 84 (manuscript received 15 Dec 83) pp 2086-2089

KOKURIN, A. D.

[Abstract] Artificial graphite is industrially produced from a mixture of petroleum coke as a filler and coal tar as a binder. The properties of the coke depend on the characteristics of the initial petroleum. Coke produced from asphaltenes and products of decomposition of resins cannot be graphitized in present-day industrial installations. The properties of coke produced from light gasoline or ethane pyrolysis resin are independent of the composition of the initial raw materials, being determined primarily by the pyrolysis conditions and products. Coke obtained by mild pyrolysis has greater graphitization than coke obtained by higher temperature pyrolysis. Coke obtained from coal tar is sometimes used as the coke filler. Carbon black is sometimes used as the filler in the production of certain graphite products. Thermoanthracite is sometimes used as the filler as well. The various fillers have various degrees of graphitization depending on the properties of the initial compounds or the mechanism of their formation. Regardless of the capability of the filler for graphitization, artificial graphite always has 10 to 12% graphitized material in the form of pitch coke, even if the filler coke is not capable of graphitizing at all. During pressing and roasting, electrodes are produced with variable distribution of binder: less at the center and more at the periphery. The central and peripheral portions thus have poorer properties, the center due to a shortage of binder, the periphery due to an excess. References 15: 14 Russian, 1 Western.  
[34-6508]

UDC 662.73:552.57

#### STEP-WISE EXTRACTION OF BROWN COALS WITH DIMETHYLFORMAMIDE

Moscow KHIMIYA TVERDOGO TOPLIVA in Russian No 5, Sep-Oct 84 (manuscript received 4 Oct 83) pp 30-34

VISHNYAKOVA, L.V., YEKATERININA, L.N., DOLMATOVA, A.G., KHRENKOVA, T.M. and ZHAROVA, M.N., Institute of Mined Fuels

[Abstract] The yield of dimethylformamide extract from coals had been correlated to the yield of liquid products during coal hydrogenation.

However, the yield of extracts from brown coals was lower than that of anthracite. A detailed study of step-wise extraction with a Soxhlet extractor, of Kansk-Achinsk brown coals shows that aromatic compounds have aliphatic or alicyclic substituents and oxygen functional groups had the greatest solubility. Preliminary vibromilling significantly increases the solubility of brown coal in dimethylformamide, while stepwise vibromilling of the brown coal extraction residue results in the formation of water-soluble products having a high content of phenolic, hydroxylic and carboxylic groups. Figures 3; references 5 (Russian). [42-12765]

UDC 662.642:542.943.5

#### OZONIZATION OF BROWN COALS AND HUMIC ACIDS

Moscow KHIMIYA TVERDOGO TOPLIVA in Russian No 5, Sep-Oct 83 (manuscript received 20 Jul 83) pp 35-39

SHISHKOV, V. F., VERKHODANOVA, N.N., YEGOR'KOV, A.N. and TUTURINA, V.V., Irkutsk Polytechnic Institute; Leningrad Technologic Institute imeni Lenoavet

[Abstract] Many theoretical and practical problems in coal chemistry may be solved by studying the action of ozone on the organic matter in coal. In the present work, brown coals of Irsha-Borodinsk and Azeysk and the humic acids extracted from them were oxidized with an ozone-air mixture in glacial acetic acid at room temperature. The ozonolysis products consisted chiefly of lower mono- and dihydroxy-ketocarboxylic acids and aromatic mono-, di- and polycarboxylic and higher aliphatic mono- and dicarboxylic acids. The qualitative and quantitative composition of the acids indicates that the structure of the coals and humic acids is chiefly aliphatic. References 7: 3 Russian, 4 Western. [42-12765]

UDC 742.331

#### COBALT-MOLYBDENUM CATALYSTS OF SPHERICAL CARBON CARRIER FOR COAL HYDROGENATION

Moscow KHIMIYA TVERDOGO TOPLIVA in Russian No 5, Sep-Oct 84 (manuscript received 31 Mar 83) pp 80-84

PEREDERIY, M.A., PCHELINA, D.P., SURINOVA, S.I., CHERKINSKAYA, K.T. and YASHINA, T.N., Institute of Mined Fuels

[Abstract] Much attention has been devoted to the development of stationary bed catalysts for coal hydrogenation because they can be regenerated and reused many times. In the present work, stationary bed coal catalysts were



prepared by impregnation of carbon spherules with cobalt nitrate and ammonium paramolybdate solutions followed by reduction for 2 hours at 420°C at 0.5 MPa hydrogen pressure. The effects of pore structure and ash content of the carbon carrier on the activity of the catalyst during coal liquifaction were studied and the active form of molybdenum oxide was determined by X-ray analysis. The activity of the above catalyst on carbon carrier was found to be close to that of industrial grade alumina-cobalt-molybdena catalyst. References 8: 4 Russian, 4 Western.  
[42-12765]

UDC 662.74:332.4

#### MECHANISM OF COAL PYROLYSIS

Moscow KHIMIYA TVERDOGO TOPLIVA in Russian No 5, Sep-Oct 84 (manuscript received 1 Sep 83) pp 107-111

GRYAZNOV, N.S. and SULIMOV, G.I., Eastern Scientific-Research Institute of Coal Chemistry

[Abstract] The high molecular structure of coal consists of aromatic, hydroaromatic, heterocyclic and aliphatic fragments and their associated functional groups. Compounds having conjugated double bonds are paramagnetic and more resistant to heat. Pyrolysis of these compounds results in further conjugation and greater heat resistance. Thermochemical conversion of coal during coking takes place via a radical polycondensation mechanism initiated by thermal destruction. The process proceeds in stages and is influenced by a decreasing isobaric-isothermal potential directed toward increasing thermal stability of the condensed phase at each given temperature. These stages are characterized by the genetic features of the coal, i.e., its particular system of polyconjugation. Figures 3; references 9 (Russian).  
[42-12765]

## COMBUSTION

UDC 662.74:665.777.4.004

### UTILIZATION OF SOLID POLYMERS IN COKING

Moscow KOKS I KHIMIYA in Russian No 10, Oct 84 pp 15-19

YEGOROV, V. M., KUTOVOY, P. M., GONCHAROV, V. F., KOSTOCHKIN, A. R.,  
GLUKHEN'-KIY, A.G., Dnepropetrovsk Institute of Metallurgy, NEYELOV, I.P.  
and STRELENKO, A. F., KhSTB [Special Design and Technical Office]  
"Mashpriborplastik"

[Abstract] One of the most simple methods to increase the tendency to cake in coal under conditions of poor crude coking base is to use organic additives. Their technical value reaches a maximum when the decomposition temperature approaches the temperature at which the coal is maintained in a plastic state. The standard plastometric method was used in studying the effect of thermoplastic polymers, based on polyethylene and polystyrene, and obtained as waste products in production of plastics, on the tendency of coal to cake during the coking process. Experimental results showed that addition of 1-3% of solid polymers had a positive effect in solving two economical problems: improvement in coke quality under conditions of impoverished crude base and utilization of mixed waste products obtained in production of plastics. Greater quantity of polymers did not improve the quality of the product, only increased the yield of volatile products. In general, with addition of 1% of polymer mixture, the coke showed adequate coarseness, smaller fissures and greater compactness. Figure 1; references 9 (Russian). [38-7813]

## NOVEL METHOD OF COOLING AND PURIFYING COKE GAS

Moscow KOKS I KHIMIYA in Russian No 10, Oct 84 pp 28-31

LYAPKIN, A. A., All-Union Scientific Research Institute of Work Safety of the AUCCTU and GLYANCHENKO, V. D., VUKHIN [Eastern Scientific Research Institute of Coal Chemistry]

[Abstract] A new method was developed for cooling and purification of dusty gases forming during continuous coking of coal based on cooling such gases with water in direct flow with overfilled layer of solid material in the drying drum. The goal of this investigation was to study this cooling process and to determine the possibility of using the lubricated material as a finished product. Preliminary tests showed that the largest amount of tar was formed with a heating rate of 3-5°/min in temperature range 350-550°C and a flow rate of the gas of 15-17 m<sup>3</sup>/hr. This process appeared to be highly effective. Varying the relationship between solid material and water, the quality of condensed tar on the surface of solid material could be changed leading to different properties of the lubricated material. Depending on the conditions of gas cooling in the drum, the tar density, its content of dust and the yield of the light fraction could be altered. The principal advantage of this process is that it yields valuable products such as bricket fuel and black top for road construction. Figure 1; references 12: 10 Russian, 2 Western.  
[38-7813]

UDC 614.841.41:662.764.2:546.17

## INVESTIGATION OF NEUTRALIZATION PROCESS OF BURNING MEDIUM USING NITROGEN DURING FIRE BREAKOUTS IN BENZENE SCRUBBERS

Moscow KOKS I KHIMIYA in Russian No 10, Oct 84 pp 57-59

ZARETSKIY, A. D., Administration of Fire Protection UVD [Administration of Internal Affairs] Dnepropetrovskaya Oblast

[Abstract] Burning media in fires occurring inside the benzene scrubbers filled with wood-filler consist of hydrocarbon-air mixture combusting during the chain reaction of chemical oxidation. Organic substances in this mixture consist of 98.4% of unsaturated and aromatic compounds (cyclopentadiene, benzene, toluene, ethylbenzene, xylene, trimethylbenzene, naphthalene, styrene and assorted hydrocarbons) and 1.6% of sulfur-containing compounds. The mechanism of layered neutralization of this burning medium with nitrogen is based on disruption of the chain reactions of the oxidation of the wood-filler destruction products due to the consumption of atomic oxygen in the formation of nitrogen oxides and dioxides. The NO and NO<sub>2</sub>, forming in this process, cool the scrubber contents down to 413 and below, as a result of the turbulent

mixing of  $N_2$  with air in the up- and down-drifts of the heat streams. In the end, the burning is stopped because of the decrease in the oxygen concentration to the level incapable of maintaining the combustion. References 8 (Russian, one by Western authors).  
[38-7813]

UDC 665.53.012-52

**AUTOMATIC PROCESS CONTROL OF PYROLYSIS OF HYDROCARBONS WITH VARIABLE COMPOSITION**

Kiev KHIMICHESKAYA TEKHNLOGIYA in Russian No 5, Sep-Oct 84 (manuscript received 31 Oct 83) pp 54-56

SERDYUK, A. N., KOSTOGRYZ, P. V. and KABACHEK, L. P., Gas Institute, UkSSR Academy of Sciences

[Abstract] An automatic control for the analysis process based on the concept of complex relationship coefficient was developed. Experimental data, comparative analysis and advantages of this method are discussed. This method makes it possible to achieve optimal control of the temperature regimen of the pyrolysis on the basis of the determination of ethylene, propylene and propane concentrations in the pyro-gas. It is applicable to a variety of load capacities under conditions of changing composition of the starting material. No other method could give analogous results. This automated method was adapted to industrial utilization. Figures 2; references 2 (Russian).  
[30-7813]



UDC: 621.355:541.138.3

REDUCTION OF OXYGEN ON SEMISUBMERGED SILVER ELECTRODE IN ALKALINE BATTERY

Leningrad ZHURNAL PRIKLADNOY KHIMII in Russian Vol 57, No 9, Sep 84 (manuscript received 5 Mar 84) pp 1973-1977

SELIVERSTOV, S. D., LYZLOV, N. Yu. and ARKHANGEL'SKAYA, Z.P.

[Abstract] Data obtained for a smooth silver electrode are compared with data for a porous silver electrode under the conditions found in a seated silver-cadmium battery. Smooth electrodes were prepared from 99.99% silver foil. Porous electrodes were prepared by pressing a mixture of highly dispersed silver powder and fluoroplastic. Measurements were performed on a semisubmerged silver electrode in a glass sealed cell in atmospheres of air, oxygen and argon. It is found that increasing the concentration of hydrogen peroxide to over  $10^{-4}$  M results in a significant increase in current flow. This is particularly true as temperature rises. As the electrode is withdrawn from the electrolyte and a thin liquid film forms on its surface, peroxy compounds accumulate in the film. The effective reaction zone on the electrode is in the immediate vicinity of the level of the electrolyte.

Figures 5; references 10: 8 Russian, 2 Western.

[34-6508]

UDC: 547.245+547.259

FREE RADICAL REACTIONS OF BIS(TRIETHYLSILYL) AND BIS(TRIETHYLGERMYL)  
MERCURY WITH ORGANIC HALIDES

Leningrad ZHURNAL OBSHCHEY KHIMII in Russian Vol 54, No 9, Sep 84 (manuscript received 6 Feb 84) pp 2025-2031

RYBIN, L. I., VYAZANKINA, O. A., VYAZANKIN, N. S., GENDIN, D. V., LESHINA, T. V., MAR'YASOVA, V. I., TARABAN, M. B. and LARIN, M. F., Irkutsk Institute of Organic Chemistry, Siberian Departments, USSR Academy of Sciences

[Abstract] The authors have shown that photochemical reactions of bis(triethylsilyl) mercury (I) and bis(triethylgermyl) mercury (II) with chloromethyl(dimethyl) chlorosilane (III) and its analogs lead to new organic mercury compounds containing labile Si-Cl or Si-OMe groups. These compounds are interesting as highly reactive sintrons. It is established in this article that interaction of (II) with chloromethyltrimethylsilane produces 1,2-bis(trimethylsilyl)ethanes, trimethylsilyl(triethylgermyl)methane, hexaethyldigermane and mercury, yield of all products 5-7%. Functionally substituted bis(silylmethyl)mercury compounds are thus produced by a method based on photochemical interaction of bis(triethylsilyl)- or bis(triethylgermyl)mercury with chloromethylsilanes. A method is developed for synthesizing benzoyl germanes based on photochemical reaction of bis(triethylgermyl)mercury with benzoic acid chlorides. The NMR spectra of the bis(silylmethyl)mercury produced indicate the possibility of coordination interaction of mercury plus the substituent at the silicon atom. References 14: 6 Russian, 8 Western.

[32-6508]

UDC: 541.183.12

FIBER SULFOcationITES BASED ON POLYPROPYLENE

Leningrad ZHURNAL PRIKLADNOY KHIMII in Russian Vol 57, No 9, Sep 84 pp 2030-2034

SOLDATOV, V. S., POKROVSKAYA, A. I., and MARTSINKEVICH, R. V.

[Abstract] Several properties of sulfocationites based on polypropylene fiber are described and their use in ion exchange chromatography is suggested. Graft copolymers were produced by grafting onto standard polypropylene filament monofibers 22  $\mu\text{m}$  thick. Grafting was performed from a 50% solution of monomers in methanol under the influence of  $^{60}\text{Co}$  radiation. The quantity of DVB was up to 8% of the total mass of monomers. Fibers were washed of homopolymer by benzene, then, after drying, the increase in mass was determined. Swelling was determined by centrifugation. Tensile strength and elongation were measured. The rate of sorption of methylene blue was studied, and equilibrium solutions were analyzed with a photoelectrocolorimeter. The volumetric capacities of the ionites produced were close to those calculated assuming that each styrene ring attaches one sulfo group. Ionites produced from polymers without DVB are unstable and lose exchange capacity when stored in air. Figures 5, references: 8 Russian.

[34-6508]

UDC 541.6:541.49:547.567:546.8

STRUCTURE OF ORTHOSEMIQUINOLATE COMPLEXES WITH TIN AND TITANIUM TRIFLUORIDES

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKAYA in Russian No 9, Sep 84 (manuscript received 21 Jun 83) pp 2002-2009

PROKOF'YEV, A. I., KASYMBEKOVA, Z. K., BUBNOV, N. N., SOLODOVNIKOV, S. P., IGNATOV, M. Ye., IL'IN, Ye. G. and KABACHNIK, M. I., Institute of Hetero-organic Compounds imeni A. N. Nesmeyanov, USSR Academy of Sciences, Moscow

[Abstract] Reactions of substituted orthobenzoquinones with Sn and Ti tetrafluorides were studied; these reactions lead to the formation of orthosemiquinolate trifluoro complexes of corresponding metals. Their EPR spectra were affected by the solvent used in their preparation: two isomeric forms of octahedral structure could be obtained differing in the arrangement of the attached ligands in respect to the central atom, which is pentacoordinated and could result in a tetragonal pyramide structure or trigonal bipyramide. The titanium complexes formed only one configuration regardless of the nature of the solvent. This is evidently due to the  $sp^3d^3$  hybridization at the octohedral structure leading to the preferred configuration with extranodal distribution of the solvent molecule. Figures 6; references 6: 5 Russian, 1 Western.

[33-7813]

UDC: 541.127+547.258.11

REACTION OF  $\alpha$ -OXIDES WITH ALKYL TINACYLATES, PART 6: INTERACTION OF PHENYLGLYCIDYL ETHER WITH SUBSTITUTED DI- AND TRIALKYL TIN BENZOATES IN ELECTRON DONOR SOLVENTS

Leningrad ZHURNAL OBSHCHEY KHIMII in Russian Vol 54, No 9, Sep 84 (manuscript received 20 Sep 82) pp 2052-2057

KLEBANOV, M. S., SHOSHINA, L. V. and SHOLOGON, I. M., Ukrainian Scientific Research Institute of Plastics, Donetsk

[Abstract] A study is reported of the reaction of phenylglycidyl ether with dibutyltinbenzoates substituted in the aromatic ring and tributyltinbenzoates in aprotic solvents: nitrobenzene and N,N-dimethylacetamide. The kinetic curves of the reactions mostly have an S shape. In the general case when



alkyltinacylates are reacted in polar coordinating media, the rate constant consists of three components: rate constants of the intramolecular complex reaction, rate constants of reaction of the complex with solvent and the rate constant of the reaction of the anion. The rate of the noncatalytic reaction between phenylglycidyl ether and di- and tributyltinbenzoates in aprotic strongly polar solvents increases with increasing electron acceptor properties of the substituents in the aromatic ring of the benzoates. A linear variation is observed only when the organic tin compound is present as molecules not bonded with the solvent. Figures 4; references 6: 5 Russian, 1 Western.  
[32-6508]

UDC: 547.258.11

#### SYNTHESIS OF N,N'-BIS(IMIDO)DIALKYL TIN

Leningrad ZHURNAL OBSHCHEY KHIMII in Russian Vol 54, No 9, Sep 84 (manuscript received 1 Dec 83) pp 2062-2064

SHCHERBAKOV, V. I., STOLYAROVA, N. Ye., TRUKHINA, T. V. and RAZUVAYEV, G. A.,  
Institute of Chemistry, USSR Academy of Sciences, Gorkiy

[Abstract] The reaction of diethyltin oxide with ortho-sulfobenzoic acid imide in boiling nitromethane produces bis(N-ortho-sulfobenzimidodiethyltin) oxide plus N,N'-bis(ortho-sulfobenzimido)diethyltin, the latter at not over 5% yield. The yield of the second product is greater when bis(N-ortho-sulfobenzimidodiethyltin) oxide is used as the initial tin compound. The N,N'-bis(ortho-sulfobenzimido)dibutyltin produced at 71% in a colorless fine crystalline substance stable in air. When treated with 0.1 N HCl in an alcohol solution, both Sn-N bonds break forming diethyltin chloride and ortho-sulfobenzoic acid imide. N,N'-bis(succinamido) dibutyltin is produced and rapidly hydrolyzes in air without external changes. Imide derivatives with strong acid properties such as ortho-sulfobenzimide are stable in air. References 4: 3 Russian, 1 Western.  
[32-6508]

UDC: 541.115

DETERMINATION OF STANDARD EVAPORATION ENTHALPY OF TRIPHENYLPHOSPHINE

Leningrad ZHURNAL OBSHCHEY KHIMII in Russian Vol 54, No 9, Sep 84 (manuscript received 3 Oct 83) pp 1935-1938

GRIGOR'YEV, A. A., KONDRAT'YEV, Yu. V. and SUVOROV, A. V., Leningrad State University imeni A. A. Zhdanov

[Abstract] A study is made of the heat of evaporation of triphenylphosphine at standard temperature. The heats of sublimation and melting were measured directly by a calorimetric method. A static tensimetric method was used to study the composition of vapor over the melt and measure the temperature variation of pressure, allowing calculation of evaporation enthalpy. The composition of vapor over the melt undergoes no chemical changes up to 648 K. The sublimation enthalpy is 350 K, melting enthalpy 353 K. References 4: 2 Russian, 2 Western.  
[32-6508]

UDC: 547.467.2 546.183

SYNTHESIS AND PROPERTIES OF PHOSPHAZINES BASED ON 2-DIAZO-,3-DICARBOXYLIC COMPOUNDS

Leningrad ZHURNAL OBSHCHEY KHIMII in Russian Vol 54, No 9, Sep 84 (manuscript received 6 Jul 83) pp 1968-1970

ARBUZOV, B. A., POLOZOV, A. M. and POLIZHAYEVA, N. A.

[Abstract] A study is made of the interaction of 2-diazo-,3-dicarboxylic compounds with tri(dimethylamido)phosphites and trimethylphosphites. It is shown that diazo derivatives of aromatic and cyclic  $\beta$ -diketones easily attach tertiary esters and amides of phosphorous acid with the formation of the corresponding phosphazines, the structure of which is confirmed by IR and  $^1\text{H}$  and  $^{31}\text{P}$  NMR spectra. 1,3-diphenyl-2-trimethoxyphosphazino-1,3,-propane dione isomerizes thermally and under the influence of trimethylphosphite to 2-(N-methyl-N-dimethoxy-phosphorylhydrazono)1,3-diphenyl-1,2,3-propane trione. References 7: 3 Russian, 4 Western.  
[32-6508]

## ATTACHMENT OF ARYLSULFENYL CHLORIDES TO DIETHYLPROPINYLPHOSPHONATES

Leningrad ZHURNAL OBSHCHEY KHIMII in Russian Vol 54, No 9, Sep 84 (manuscript received 12 Jul 83) pp 1971-1974

KHUSAINOVA, N. G., NAUMOVA, L. V., BERDNIKOV, Ye. A. and PUDOVIK, A. N., Kazan State University imeni V. I. Ul'yanov-Lenin

[Abstract] A study is reported of the reaction of sulfenylchlorides with phosphorylated acetylene. The attachment of phenyl- and p-tolyl sulfenyl chloride to diethylpropinylphosphonate was studied. The reaction occurs strictly stereoselectively with the formation of two regioisomerized products of attachment, according to and contrary to the Markovnikov rule. References 13: 11 Russian, 2 Western.  
[32-6508]

IR SPECTROSCOPY STUDY OF DIMETHYLISOCYANATOPHOSPHITE REACTION WITH DIACETYL AND ESTERS OF  $\alpha$ -KETOCARBOXYLIC ACID

Leningrad ZHURNAL OBSHCHEY KHIMII in Russian Vol 54, No 9, Sep 84 (manuscript received 24 Oct 83) pp 1974-1979

YARKOVA, E. G., KONOVALOVA, I. V., BURNAYEVA, L. A., KASHTANOVA, N. M., KHAFIZOVA, G. S. and PUDOVIK, A. N., Kazan State University imeni V. I. Ul'yanov-Lenin

[Abstract] A study is reported of the reaction of dimethylisocyanatophosphite with diacetyl, pyruvic and benzoyl formic acid esters by IR spectroscopy to confirm that the reaction mechanism includes intermediate formation of bipolar ions with subsequent phosphonate-phosphate regrouping of the ions and closing of the ring with a P=N bond. Subsequent imide-amide regrouping leads to the formation of substituted phospholanes with a P-C bond in the ring. The IR spectroscopy shows that the reaction involves one of two carbonyl groups with intermediate formation of azaphospholenes with P=M bond and dioxaphospholenes with pentacoordination phosphorus atom. Figures 4; references 6 (Russian).  
[32-6508]

## X-RAY STRUCTURAL STUDIES OF 1-TRIMORPHOLINOPHOSPHAZIDO-2,4,6-TRINITROBENZENE

Leningrad ZHURNAL OBSHCHEY KHIMII in Russian Vol 54, No 9, Sep 84 (manuscript received 4 Aug 83) pp 1979-1985

CHERNEGA, A. N., ANTIPIN, M. Yu., STRUCHKOV, Yu. T., BOLDESKUL, I. Ye., PONOMARCHUK, M. P., KASUKHIN, L. F. and KUKHAR', V. P., Institute of Hetero-Organic Compounds imeni A. N. Nesmeyanov, USSR Academy of Sciences, Moscow; Institute of Organic Chemistry, Ukrainian SSR Academy of Sciences, Kiev

[Abstract] An x-ray structural study of 1-trimorpholinophosphazido-2,4,6-trinitrobenzene (I) is reported. Compound (I) crystallizes from acetonitrile as orange prisms melting with decomposition at 155-156°C. Upon extended boiling in benzene or dioxane, elimination of nitrogen from this phosphazide does not occur. A comparison of geometric parameters of analog molecules shows that the P-N bond is significantly shortened with an increase in the coordination number of the phosphorus atom from 3 to 4 and has minimal length in the phosphonium structure. In the structure of (I), phosphorus has somewhat distorted tetrahedral coordination with maximum deviation of valent angles from the ideal not over 4.2°. Sequential placement of atoms in the  $PN_3$  fragments, the E-configuration of which determines the increased thermal stability of this phosphazide, is determined. References 17: 2 Russian, 15 Western.  
[32-6508]

## AZIDOPHOSPHITES, PART 4: CHLORINATION OF DI-(1,1-DIMETHYL-2,2,2-TRICHLOROETHYL) AZIDOPHOSPHITE AND ITS ANALOGS

Leningrad ZHURNAL OBSHCHEY KHIMII in Russian Vol 54, No 9, Sep 84 (manuscript received 18 Jul 83) pp 1985-1989

BUDILOVA, I. Yu., GUSAR', N. I. and GOLOLOBOV, Yu. G., Institute of Organic Chemistry, Ukrainian SSR Academy of Sciences, Kiev

[Abstract] Continuing their studies of the chemical properties of trivalent phosphorus acid azides and the search for stable compounds of this type, the authors investigate the possibility of stabilizing a compound by shielding the phosphorus atom by volumetric substituents, producing di-(1,1-dimethyl-2,2,2-trichloroethyl)azidophosphite (I). When azidophosphite (I) interacts with an equivalent quantity of chlorine with cooling, azidodichlorophosphorane (III) is formed as a mobile mass. The product of chlorination of the diamidoazidophosphite has the structure of a quaternary phosphonium salt. The azidopyrocatechin phosphite forms with an equivalent quantity of chlorine with cooling a very unstable thermal product which rapidly decomposes,



liberating nitrogen at a temperature as low as 0-+5°C. Transformations indicate that chlorination of the pyrocatechin azidophosphite forms a product with azidophosphorane structure. References 10: 5 Russian, 5 Western. [32-6508]

UDC: 547.341

#### SYNTHESIS AND CH-ACIDITY OF CERTAIN DIETHYLPHOSPHONYLMETHYLFURANS

Leningrad ZHURNAL OBSHCHEY KHIMII in Russian Vol 54, No 9, Sep 84 (manuscript received 28 Jun 83) pp 1990-1993

PEVZNER, L. M., TEREKHOVA, M. I., IGNAT'YEV, V. M., PETROV, E. S. and IONIN, B. I.

[Abstract] The purpose of this work was to develop methods to synthesize phosphonylmethylfurans and study their CH acid properties. A series of  $\alpha$ -phosphonomethylfurans and one  $\beta$ -phosphonylmethylfuran were synthesized. The Michaelis-Bekker reaction plus electrophilic substitution at the furan group of 2-phosphonylmethylfuran were used to synthesize the substituted phosphonomethylfurans. The activity of halogen alkyls depends on the position of the halogen methyl group and the presence of acceptor substituents in the group. The phosphonylmethyl group decreases the reactivity of the ring in the reaction of electrophilic substitution. The CH acidity of the phosphonomethylfurans is somewhat higher than their benzyl analogs.  $\beta$ -Phosphonomethylfurans are only slightly weaker CH acids than their  $\alpha$  analogs, indicating the great role of mesomer effects in formerly nonconjugate systems in the case of the furan ring. References 14: 10 Russian, 4 Western. [32-6508]

UDC: 547.26'118+547.491.4

#### ALKYLATION OF POTASSIUM THIOCYANATE WITH PHOSPHORYLATED CHLORALUREA DERIVATIVES

Leningrad ZHURNAL OBSHCHEY KHIMII in Russian Vol 54, No 9, Sep 84 (manuscript received 29 Nov 83) pp 2000-2002

NIKONOROV, K. V., APTOKHINA, L. A., MERTSALOVA, F. F. and LATYPOV, Z. Ya., Institute of Organic and Physical Chemistry imeni A. Ye. Arbuzov, Kazan Branch, USSR Academy of Sciences

[Abstract] A study was made of the interaction of KSCN with N-dialkoxyphosphoryl-N'-1,2,2,2,-tetrachloroureas obtained previously. The reaction was performed in acetone at 20-30°C with the equivalent relationship of reagents. The end products of the reaction are N-dialkoxy-phosphoryl-N'-(1-isothiocyanato-2,2,2,-trichloroethyl) ureas (I-III). The substances are crystals or thick

liquids which do not distill under vacuum. Their structure and composition are confirmed by IR and  $^{31}\text{P}$  NMR spectroscopy, elemental analysis and reactions with aniline. References 4: 3 Russian, 1 Western.  
[32-6508]

UDC: 547.244

#### SYNTHESIS AND CERTAIN CONVERSIONS OF O,O-DIETHYL(1-o-CARBORANYLMETHYL)PHOSPHONITE

Leningrad ZHURNAL OBSHCHEY KHIMII in Russian Vol 54, No 9, Sep 84 (manuscript received 26 Dec 83) pp 2002-2004

KAZANTSEV, A. V., MEYRAMOV, M. G. and ZAKHARKIN, L. I., Institute of Hetero-organic Compounds imeni A. N. Nesmeyanov, USSR Academy of Sciences, Moscow

[Abstract] O,O-Diethyl(1-o-carboranylmethyl)phosphonite (I) is synthesized and some of its conversions studied. When o-carboranylmethylmagnesium bromide acts on diethylchlorophosphite in the presence of pyridine, compound I is easily formed. It reacts readily with  $\text{P}_3\text{HI}$  yielding a product of Arbuzov regrouping - O-ethyl(1-o-carboranylmethyl)chlorophosphinate (III) the hydrolysis of which leads to O-ethyl(1-o-carboranylmethyl)phosphonate (IV) without hydrolytic breaking of the C-P bond. Compound (I) easily forms a complex with  $\text{CuCl}$ , a viscous liquid which is easily soluble in organic solvents. The effect of sulfur or hydrogen chloride on (I) ether leads to O, O-diethyl(1-o-carboranylmethyl)thionophosphonate (VII) and O-ethyl(1-o-carboranylmethyl)phosphonite (VIII). Hydrolysis of (I) ether with alcoholic alkali does not break the C-P bond and leads to (o-carboranylmethyl)phosphinous acid (IX). It thus manifests properties characteristic of ordinary dialkylphosphonites. References: 9 Russian.  
[32-6508]

UDC: 541.8

#### SOLUBILITY AND INTERACTION OF ORGANOPHOSPHORUS MOLECULES IN SOLVENTS AND LIQUIDS

Leningrad ZHURNAL OBSHCHEY KHIMII in Russian Vol 54, No 9, Sep 84 (manuscript received 22 Sep 83) pp 2136-2141

LI EN ZO, ABRAMZON, A. A., ZAYCHENKO, L. P., PROSKURYAKOV, V. A. and SLAVIN, A. A., All-Union Scientific Research Technologic Institute of Antibiotics and Enzymes for Medical Purposes, Leningrad

[Abstract] This work is performed to establish the solubility of organophosphorous compounds in organic solvents and in water as a function of molecular structure and intermolecular interactions. Allyl substituted phosphates, phosphonates, phosphinates, phosphinoxides and phosphites are studied with 1 to

8 carbon atoms in the aliphatic chains. Data on solubilities are used to calculate the interaction energies in solutions of alkyl substituted compounds of these classes. The increments in interaction energy per polar group and aliphatic radical are determined. Figures 2; references 8: 7 Russian, 1 Western.  
[32-6508]

UDC: 546.221+547.118:541.127

#### ALCOHOLYSIS OF DIALKYLCHLOROTHIOPHOSPHATES IN LOWER ALIPHATIC ALCOHOLS

Leningrad ZHURNAL OBSHCHEY KHIMII in Russian Vol 54, No 9, Sep 84 (manuscript received 9 Dec 83) pp 2141-2144

LEBEDEV, N. N., KIRYUSHATOVA, T. V. and SAVEL'YANOV, V. P., Novomoskovsk Branch, Moscow Institute of Chemical Technology imeni D. I. Mendeleyev

[Abstract] This work continues earlier works in studying the reaction of alcohols with phosphorous thiochloroxide. The values of rate constants obtained are presented in a table, and are seen to change regularly with a change in structure of the alcohol or alkoxy groups in the molecule of dialkylchlorothiophosphate, decreasing with increasing length and branching. A real measure of reactivity of both reagents involved in the reaction is the relative acidity of the corresponding alcohols. This reaction is similar to the reaction of dialkylchlorophosphates with alcohols, the dialkylchlorothiophosphates differing only in their lower reactivity and selectivity. References 11: 10 Russian, 1 Western.  
[32-6508]

UDC: 542.91:547.1'118

#### POSSIBILITY OF FORMING 1,3,2,-DIOXAPHOSPHOLANE RING UPON ALCOHOLYSIS OF TRIS (DIETHYL-AMIDO)PHOSPHITE BY METHYL- $\alpha$ -D-GLUCOPYRANOSIDE

Leningrad ZHURNAL OBSHCHEY KHIMII in Russian Vol 54, No 9, Sep 84 (manuscript received 27 Jan 84) pp 2150-2151

GURARIY, L. I., CHERNOV, A. N., MUSINA, A. A., MUKMENEV, E. T. and ARBUZOV, B. A., Institute of Organic and Physical Chemistry imeni A. Ye. Arbuzov, Kazan Branch, USSR Academy of Sciences

[Abstract] It has been assumed that the cyclic phosphorus-containing fragment in the molecules of monomer products of alcoholysis of  $P(NEt_2)_3$  by methyl- $\alpha$ -D-glucopyranoside must have 6 members. The authors have obtained data indicating the formation in these reactions of 5-membered 1,3,2-dioxaphospholane rings with the participation of one of the two trans- $\alpha$ -diol groups of the methyl- $\alpha$ -D-glucopyranoside molecule. As a result of chromatographic separation of the products of successive interaction of the two

compounds, two of four possible P-diastereomers were obtained: methyl-2,3,4,6-bis-O-(N-diethylamidophosphate)- $\alpha$ -D-glucopyranoside,  $C_{15}H_{30}N_2O_6P_2S_2$ . Reference 1 (Russian).  
[32-6508]

UDC: 547.467.2

ETHYL(DIETHOXYTHIOPHOSPHORYL-DIAZO)ACETATE - FIRST DIAZO CARBONYL COMPOUND WITH THIOPHOSPHORYL GROUP

Leningrad ZHURNAL OBSHCHEY KHIMII in Russian Vol 54, No 9, Sep 84 (manuscript received 6 Feb 84) pp 2151

POLOZOV, A. M., POLEZHAYEVA, N. A. and ARBUZOV, B. A., Scientific Research Chemical Institute imeni A. M. Butlerov; Kazan State University imeni V. I. Ul'yanov-Lenin

[Abstract] When t-BuOK and p-TosN<sub>3</sub> are interacted in sequence with ethyl (diethoxyphosphoryl)acetate and silica gel chromatography is performed, the first representative of the diazocarbonyl compounds containing a thiophosphoryl group is produced with a yield of 22% as a green mass, boiling point 65-66°C (0.025 mmHg). NMR spectra are described. References 2: 1 Russian, 1 Western.  
[32-6508]

UDC: 547.26'118

INTERACTION OF TRICHLOROMETHYLDICHLOROPHOSPHINE WITH ALCOHOL AND PHENOL

Leningrad ZHURNAL OBSHCHEY KHIMII in Russian Vol 54, No 9, Sep 84 (manuscript received 26 Dec 83) pp 2152-2153

GAZIZOV, T. Kh., USMANOVA, L. N. and PUDOVNIK, A. N., Institute of Organic and Physical Chemistry imeni A. Ye. Arbuzov, Kazan Branch, USSR Academy of Sciences

[Abstract] It was found that the interaction of trichloromethyldichlorophosphine (I) with alcohols in the presence of triethylamine occurs by a complex path. Dialkyltrichloromethylphosphonite is not formed as the only reaction product. The reaction of phosphine (I) with amyl alcohol (II) with no base at room temperature and decreased pressure (200 mmHg to remove HCl as it is liberated) produces amyltrichloromethylchlorophosphonite (III), yield 49%, bp 88°C. Phosphine (I) interacts with butyl alcohol (V) to form dibutylphosphite (VI), yield 75.4%, bp 121-122°C. The reaction of phosphine (I) with phenol forms triphenylphosphite, yield 5.6%, bp 170°C. Thus, not only the chlorine atoms but also the trichloromethyl group of the phosphine are easily substituted. References 5: 3 Russian, 2 Western.  
[32-6508]



ARYLHYDRAZONES OF  $\beta$ -OXOTRIPHENYLPHOSPHONIUM SALTS

Leningrad ZHURNAL OBSHCHEY KHIMII in Russian Vol 54, No 9, Sep 84 (manuscript received 12 Dec 83) pp 2153-2154

MEGERA, I. V., Chernovtsy Medical Institute

[Abstract]  $\beta$ -oxotriphenylphosphonium salts were reacted with hydrazine derivatives. It was found that the salts enter into condensation reactions with hydrazine derivatives in organic solvents (dimethylformamide, chloroform, etc.) upon heating, forming crystalline colored phosphonium hydrazones. The formation and yield of the hydrazones depend on the solvent used and temperature conditions. Duration of the reaction is determined by the structure of the initial phosphonium salts and arylhydrazine. References 2 (Russian). [32-6508]

UDC: 547.241+547.26'118

## SYNTHESIS AND REGROUPING OF IMIDOYLPHOSPHITES

Leningrad ZHURNAL OBSHCHEY KHIMII in Russian Vol 54, No 9, Sep 84 (manuscript received 31 Jan 84) pp 2154-2155

MALENKO, D. M., REPINA, L. A. and SINITSA, A. D., Institute of Organic Chemistry, Ukrainian SSR Academy of Sciences, Kiev

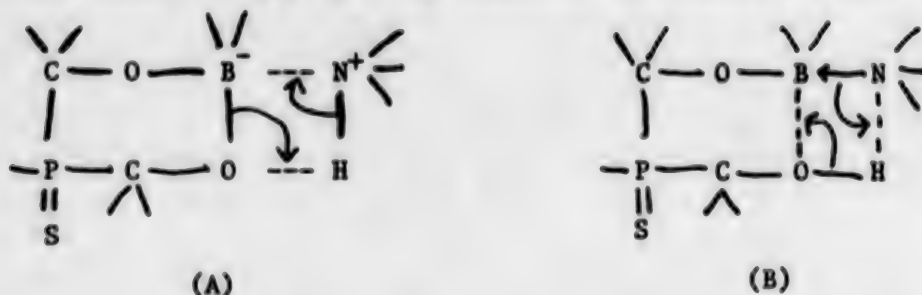
[Abstract] Dialkylphosphites interact with imidoyl chlorides (I) in the presence of triethylamine at the oxygen forming imidoylphosphites (II). Analytic data and spectral characteristics of compounds (II) agree with the structure suggested. Imidoylphosphites (II) when heated in a vacuum undergo imidoylphosphite-imidoylphosphonate regrouping. This same regrouping occurs in the presence of triethylamine hydrochloride at room temperature in several days. The structure of the compounds thus formed is confirmed by the identity of properties of one of them with a specimen obtained by the Arbuzov reaction from imidoyl chloride (I) and triethylphosphite. Reference: 1 Western. [32-6508]

## RING-CHAIN TAUTOMERISM OF DIPHENYLBORYLHYDROXYMETHYL(HYDROXYMETHYL)PHENYLPHOSPHINE SULFIDE COMPLEXES WITH AMINES

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKAYA in Russian No 9, Sep 84 (manuscript received 12 Jul 83) pp 2089-2093

ARBUZOV, B. A., YERASTOV, O. A. and NIKONOV, G. N., Institute of Organic and Physical Chemistry, Kazan Branch, USSR Academy of Sciences

[Abstract] Ring-chain tautomerism was studied on the following two complexes: diphenylborylhydroxymethyl(hydroxymethyl)phenylphosphine sulfide (I) with  $C_2H_5N$  and I with  $Et_3N$ . Both forms have characteristic IR absorption bands: in the open chain form it is the hydroxy group, in the cyclic form -- the  $-N^+-H$  band. This tautomeric process is a complex-salt tautomerism. The transitions occur through the four centered intermediate states A and B:



Redistribution of electron density in (A) leads to a complex form and in (B) -- to the salt form. This represents the difference between this and the normally observed ring-chain tautomerism, in which  $H^+$  transfer is not accompanied with the formation of a cation and an anion. Figures 3; references 4 (Russian). [33-7813]

## SPIN TAGGED ORGANOPHOSPHORIC CHOLINOLYTIC

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKAYA in Russian No 9, Sep 84 (manuscript received 28 Jun 83) pp 2094-2097

KARDANOV, N. A., TRIFONOVA, S. A., ZHDANOV, R. I., AL'TMAN, I. B., GODOVIKOV, N. N. and KABACHNIK, M. I., Institute of Heteroorganic Compounds imeni A. N. Nesmeyanov, USSR Academy of Sciences, Moscow

[Abstract] 4-Hydroxy-4- $[\beta$ -(N-methyl-N-phenyl)aminoethyl]phenylphosphinyl-2,2,6,6-tetramethylpiperidine-1-oxylmethyl iodide (I), an organophosphoric nitroxyl radical with possible cholinolytic and anticholinesterase activity, was synthesized by the Abramov reaction. Triacetoneamine was added to  $[\beta$ -(N-methyl-N-phenyl)aminoethyl]phenylphosphonite (II) under mild conditions

(ether, 20°C) to yield 4-hydroxy-4-[ $\beta$ -(N-methyl-N-phenyl)aminoethyl]phenylphosphinyl-2,2,6,6-tetramethylpiperidine (III), m.p. 141-143°C. Oxidation of III with  $\text{PhCO}_3\text{H}$  in THF gave 4-hydroxy-4-[ $\beta$ -(N-methyl-N-phenyl)aminoethyl]phenylphosphinyl-2,2,6,6-tetramethylpiperidin-1-oxyl (IV), m.p. 158-160°C, which upon addition of excess MeI gave I, m.p. 117-120°C. This radical can be used as a spin probe in studies of cholinesterases and muscarine cholinoreceptors. Figures 1; references 8: 7 Russian, 1 Western. [33-7813]

UDC 542.91:547.1'128'118:547.573

#### REACTIONS OF PHENYL- AND TRIMETHYLSILYLPHENYLPHOSPHINES WITH THIOBENZOPHENONE

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKAYA in Russian No 9, Sep 84 (manuscript received 26 Sep 83) pp 2116-2117

ROMANOV, G. V., RYZHIKOVA, T. Ya. and PUDOVIK, A. N., Institute of Organic and Physical Chemistry imeni A. Ye. Arbuzov, Kazan Branch, USSR Academy of Sciences

[Abstract] Trimethylsilylphenylphosphine (I) reacts with carbonyl compounds forming 1-trimethylsiloxyalkylphosphines. In the present paper the reactions of I with thiobenzophenone were shown to yield 1-(trimethylsilylthio)benzhydrylphenyl phosphine, a yellow oil which was then hydrolyzed to 1-mercaptobenzhydrylphenylphosphine (II), a viscous mass. When heated to 100°C in sealed ampule, II yields S,S,-dibenzhydrylphenyltrithiophosphonate, m.p. 96°C. References 3: 2 Russian, 1 Western. [33-7813]

UDC 543.876:547.1'118

#### STABILITY OF 2-HYDROXYALKYL ESTERS OF THIO- AND SELENOPHOSPHORIC ACIDS WITH TWO 1,1-DIMETHYL-2,2,2,-TRICHLOROETHOXYL SUBSTITUENTS AT PHOSPHORUS ATOM

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKAYA in Russian No 9, Sep 84 (manuscript received 12 Dec 83) pp 2134-2136

ARBUZOV, B. A. and NURETDINOVA, O. N., Institute of Organic and Physical Chemistry imeni A. Ye. Arbuzov, Kazan Branch, USSR Academy of Sciences

[Abstract] It was shown that addition of two 1,1-dimethyl-2,2,2-trichloroethoxy groups to the phosphorus atom of 2-hydroxyalkyl esters of dialkylthio- and dialkylselenophosphoric acids stabilized them, preventing the hydroxythiol and hydroxyseleno rearrangement. The stability of the selenium esters was slightly lower than that of the thiol homologues. Physical-chemical data of all compounds obtained were tabulated. References 2 (Russian). [33-7813]

## CONVERSION OF 3-HYDROXYALKYL ESTERS OF TETRAALKYLDIAMIDOTHIOPHOSPHORIC ACIDS

Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA KHIMICHESKAYA in Russian No 9, Sep 84 (manuscript received 12 Dec 83) pp 2136-2138

NURETDINOVA, O. N. and GUSEVA, F. F., Institute of Organic and Physical Chemistry imeni A.Ye. Arbuzov, Kazan Branch, USSR Academy of Sciences

[Abstract] Free tetraalkyldiamidothiophosphoric acids are unstable and become tarry upon heating. To synthesize 3-hydroxyalkyl esters of tetraalkyldiamidothiophosphoric acid, triethylammonium salt of this acid was heated to 85-90°C with 1-bromobutanol-3 yielding 2-oxo-2-diethylamino-4-methyl-1,3,2,-thioxaphosphorinane, b.p. 82-82.5°C/0.05 mm Hg,  $d_4^{20}$  1.1346,  $n_D^{20}$  1.4900. References 2: 1 Russian, 1 Western.  
[33-7813]



UDC: 547.258.11:632.952

MEANS FOR INCREASING BIOLOGICAL ACTIVITY OF N-ORGANIC TIN IMIDE DERIVATIVES  
OF CERTAIN DICARBOXYLIC ACIDS

Leningrad ZHURNAL PRIKLADNOY KHIMII in Russian Vol 57, No 9, Sep 84 (manuscript received 21 Jul 83) pp 2063-2066

SHCHERBAKOV, V. I., STOLYAROVA, N. Ye., ANISIMOV, A. A., FEL'DMAN, M. S., SMIRNOV, V. F. and D'YACHKOVSKAYA, O. S., Institute of Chemistry, USSR Academy of Sciences; Gorkiy State University imeni N. I. Lobachevskiy

[Abstract] A report is presented on the possibility of increasing the fungicidal activity of compounds  $R_3SnX$  in triethylstannyl and tributylstannyl compounds by changing the structure of the X group, using N-triorganostannyl imides containing amino or alkoxy groups as examples. Organic tin derivatives were studied which contain fragments which have common structural features with a number of mold fungus metabolites. The minimal fungicidal concentrations of these derivatives are quantitatively determined. It is found that the fungicidal activity of triethylstannyl derivatives is increased when the hydrogen atoms in the side chain of the imide fragment are replaced by bromine atoms, particularly if one of the bromine atoms in the heterocycle is replaced by an amino group. N-Tributylstannyl derivatives of the imides of certain substituted asparaginic acids have significantly greater fungicidal activity than the initial substance, their minimum fungicidal concentration being two orders of magnitude lower. A synergic fungicidal effect was discovered for a mixture of organic tin compounds and compounds of similar structure not containing the  $R_3Sn$  fragment. References 15: 12 Russian, 3 Western.  
[34-6508]

## PETROLEUM PROCESSING TECHNOLOGY

### 'GENETIC CODE' FOR ORIGIN OF PETROLEUM

Leningrad LENINGRADSKAYA PRAVDA in Russian 15 Sep 84 p 2

[Article by B. Sokolov, Moscow State University professor: "About the 'Genetic Code'"]

[Text] How did oil and gas come to exist on this planet? How many of these hydrocarbons do the earth's depths hold? According to what laws did their deposits evolve on a geological time scale? These are the questions which have given researchers no peace for many years. Soviet scientists gave their opinions on several of them at a conference held recently at Moscow State University imeni M. V. Lomonosov. By request of APN [NOVOSTI Press Agency], MSU Professor B. Sokolov will tell the story.

### PROTO-OIL: WHICH WAY THE SCALES TIP!

A century and a half will soon have passed since the beginning of the industrial extraction of hydrocarbons. During this time, about 60 billion tons of oil and 30 trillion cubic meters of gas have been extracted from the earth's interior and 30,000 oil and gas deposits have been discovered. Until now, scientists have not come to a single opinion on the origin of these most important of useful fossils. The "100 year war" continues between supporters of oil originating due to biosphere products and those who consider its source to be matter from the earth's deep zones. The success for searches for new deposits and their quantitative values depends on the correct answer.

The All-Union conference recently held at Moscow State University dealt with the evolution of oil-formation in the earth's history. The majority of its participants took the position of an organic origin of oil. On the basis of their latest research, it was shown that the basic mass of oil and natural gas was formed due to the transformation of scattered organic matter which accumulated together with mineral particles of sedimentary rock in sea, oceanic and lake reservoirs. More than 90 percent of organic matter is comprised of the remains of the simplest microscopic organisms of the bacterial type, as well as blue-green, green and diatomic algae and other organisms related to phyto- and zoo-plankton. A portion of them existed on the earth a billion years ago. Vegetable matter, the export of which by rivers and

continents began to take place the last 400 million years, plays a significantly smaller role and is mainly a source of gas.

Entirely new confirmations of a connection between the original matter of oil and gas and the biosphere are emerging. Several important consequences come out of this. Since the biosphere has global distribution on the earth, meaning it is everywhere, the accumulation of original organic matter for oil formation takes place where there are reservoirs. This process began 3.5-4 billion years ago when the biosphere appeared and it continues until present time.

Soviet Scientist and Academician Ivan Mikhaylovich Gubkin's (1871-1939) ideas have completely confirmed the fact that oil formation has a global and invariable character. In sedimentary basins where hole drilling is being done, it has practically always worked well to detect oil and gas accumulations by different sizes.

#### FROM THE CONFORMITY OF EVOLUTION TO THE CONFORMITY OF SEARCH

The concept of phasic quality of oil formation which was developed by distinguished Soviet scientist Nikolay Bronislavich Vassoyevich (1902-1981) is getting increasing recognition. Oil in sedimentary rock is formed only when organic matter from oil matrix deposits sinks by a depth of 2-4 km where interior temperature reaches 80-120°C. This region has been called the main oil formation zone. Further sinking of deposits brings them to a zone with higher temperatures -- 150-250°C (at depths of 4-6 km and more). In these layers, oil formation gives way to intensive gas formation.

Thus, the process of oil and gas origination is caused by the deep sinking of sedimentary rock and its intense heating. This is why only high-capacity basins like Western Siberia, the Caspian Basin and the Persian and Mexican Gulfs contain significant quantities of oil and gas deposits.

Oil formation is a lengthy historical process which depends not only on the quantity and quality of oil matrix organic matter, but on the sinkage dynamics and heating intensity. The study of present day large oil and gas bearing basins has shown that all of them are sedimentary rock with high capacities not less than 5-10km and which are formed at a rate of more than 80 meters per million years.

Such intense sedimentation which is accompanied by intense heating is characteristic of certain tectonic zones of the earth's core: so-called rift and geosynclinal depressions (the formation mechanism of these depressions has been found out only most recently). Lake Baykal and Suetskiy Gulf are examples of rift depressions. The Mediterranean and Black Seas, the Gulf of Mexico and the Indonesian Sea can be attributed to geosynclinal depression. All the areas of water are large sedimentary basins with a sedimentary layer 5-15km thick and they are characterized, as a rule, by noticeable oil content.

Research conducted on the geologic conditions of sedimentary layer heating has shown that it is associated with two simultaneously acting processes: on one hand, the appearance of tectonic disturbance zones which arise as a result

of tension (a moving apart) of the earth's core; on the other hand, a well-heated flow of water, oxygen, helium, carbonic acid, methane and other components which rise from the mantle and lower parts of sedimentary layers. This flow, with a temperature of several hundred degrees, moves about tectonic disturbance zones heating the sedimentary layer and furthering the "ripening" of organic matter. At the same time, it dissolves liquids and gaseous hydrocarbons forming in the layer, extracts matrix from it and transfers it into the collector horizons and traps.

Thus, we arrive at a very important conclusion -- only those sedimentary basins in which a triune of conditions are observed are oil-bearing. These conditions are the accumulation of deposits under tension conditions, their significant capacity and intense heating of ascending gas-liquid flows. This "genetic code" must be used in practice during searches.

There are still two more considerations. First, the thesis about non-replenishment of oil and gas resources doesn't sound entirely correct today. The processes of oil and gas generation are going on now in sedimentary basins which are under heating conditions and future deposits are being formed in them. And second, one should look at oil and natural gas in the capacity of independent hydrocarbon covers of the earth.

It's a fact that on other Solar System planets where some kinds of life forms are known not to have existed, you will never find these useful fossils which are so highly valued by us.

12614

CSO: 1841/58



## RESERVES OF GAS CONDENSATE

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 10 Oct 84 p 1

[Interview by TASS correspondent P. Ryabov with A. Gritsenko, Director of the Natural Gas Scientific Research Institute]

[Text] Evidence for the significant contribution of gas extractors to the economic potential of our country from the present to the year 2000 is to be found in the general plan for the future development of the gas industry of the USSR. The VNIIGaz [Natural Gas Scientific Research Institute] developed this plan within the framework of the Energy Program. This document devotes a considerable amount of space to the large-scale extraction of gas condensate, valuable raw material for the production of automobile and aircraft fuels, diesel fuel and other chemical compounds. Institute Director A. Gritsenko comments for TASS correspondent P. Ryabov on the stages of development of this fundamentally new industrial subbranch.

"The 27th CPSU Congress set before us the concrete and very important task of increasing the yield of gas concentrate and providing for its more complete utilization. A team from our institute is making its own contribution to the successful solution of this problem. Two years ago at the Urengoy field the first operational bores were drilled for the production of condensate. Using technology developed by our institute, the shafts penetrated the entire thickness of almost twenty natural-gas producing strata and at a depth of about 3,000 meters reached reservoirs of "white oil," as condensate is often called.

"At Urengoy, methods were developed for extracting the condensate and processing it on site. Following the plans of our institute, equipment was assembled at an experimental plant for the extraction of motor fuels from the condensate. This unit is to be recommended highly, since it has been of significant assistance to the northerners in providing local industry with gasoline and diesel fuel. Now, the Urengoy mines have an installation updated by the institute and operating at twice the capacity of the original one. Scientists, in collaboration with specialists of the Central Committee of the TAKB [expansion unknown, possibly Central Control Bureau] of Petroleum Equipment have developed a design for a unit which can produce four times as much condensate per year. Such installations are being manufactured for various raw-material-producing regions of the USSR where promising reservoirs have been discovered.

"We have made a second practical step forward in beginning to develop a method for the preparation of valuable raw material for transport to the centralized processing plants. At this same Urengoy bore we are constructing a stabilization installation, which will extract undesired impurities from the raw material before it is shipped out. The recommendations of our institute have also been taken into account in equipping the 700-kilometer condensate pipeline, which will take the condensate to Surgut, where a gas processing plant is under construction. This plant will also use equipment designed in collaboration with specialists of VNIIGaz. Several million tons of gas condensate are expected to be extracted in Western Siberia by the end of the 5-Year period.

"Finally, in developing a plan for the experimental-industrial mining of the Karachaganak field in the Caspian Depression, scientists have been closely looking into the more complete extraction of condensate from the depths. It has been decided to introduce technology developed at the Novo-Troitsk reservoir (Ukraine). Injecting dry gas into the producing stratum has made it possible to maintain an optimal pressure, and thus to increase the yield of raw materials by 20-30 percent. The exploitation of Karachaganak has begun, operating bores have been drilled to a depth of 5,000 meters, and preparations are under way for shipping production to the Orenburg Gas and Petroleum Plant. Eventually, the Ural area will have its own gas-chemical complex, alongside its mines.

"The general plan for the development of the Soviet gas industry also calls for the widespread exploitation of other gas-condensate reservoirs, the Astrakhan, Yamburg, and Trans-Polar fields, making possible the planned increase in yield of condensate."

9832

CSO: 1841/29

#### AUTOMATED METHANOL PLANT ON STREAM

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 25 Sep 84 p 1

[Article in column "Labor Rhythm of the Five Year Plan (Fourth Year)," by P. Agapov]

[Text] A few days ago the largest complex in the world for producing methanol produced its first product at the Gubakhinskiy Chemical Factory. This was the culmination of a great and intense effort by the construction workers, fitters and setters-up from more than 40 organizations from various cities of the country.

The uniqueness of the new complex is illustrated by the fact that the huge production during one shift is accomplished by 20 workers in all. Such is the level of automation of the technological processes here. Workers at the complex are called operators, and the shifts are headed by highly qualified engineers.

Already, the first production tons have shown that the quality of Gubakhinskiy methanol is at the level of world standards. Operators at this unique plant have promised that before the end of the year the methanol plant will be brought to projected capacity.

12318

CSO: 1841/11

## BRIEFS

**KAMA OIL PRODUCTION**--The Kama producers have extracted 50 thousand tons of oil above the plan. They fulfilled their annual socialist requirement ahead of schedule. The search by collective reserves of the "Permneft'" Union is being conducted in many directions. The majority of deposits allotted to them have already been exploited many years. Methods of thermal and chemical action help maintain the optimal oil return of strata. New underground larders are being drawn into assets. They are located in the northern Perm Oblast in difficult to reach regions. It is not easy to get there with drilling and producer equipment, but the first to pass through are successfully solving this problem. Having gained an important boundary, the oil extractors are planning a new one: to give 20 thousand tons more of "black gold" above the plan by the end of the year. [V. Ukolov] [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 4 Nov 84 p 1] 12614

**NEW GAS PIPELINE**--The first million cubic meters of "blue fuel were sent through the pipeline by complex gas preparation plant No 16 which was built on the new Karachagansk gas-condensing deposit. Beginning its route in the Ural Oblast, the underground main crosses the steppe and joins Karachagansk with the Orenburg gas-processing plant. The experimental industrial exploitation of the deposit first in line which is calculated at an extraction and transport of 3 million cubic meters of fuel a year was begun during the holidays. [I. Payvin] [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 4 Nov 84 p 1] 12614

CSO: 1841/58



UDC 665.658.26:665.633

EFFECT OF CHLORINE-ORGANIC COMPOUNDS ON EXTENT OF HYDROFINING OF GASOLINE FRACTIONS

Leningrad ZHURNAL PRIKLADNOY KHIMII in Russian Vol 57, No 8, Aug 84  
(manuscript received 5 Mar 83) pp 1816-1818

SHAPIRO, R.N., GLOZSHTeyN, A.Ya., KRAYEV, Yu.L. and GIL'CHENOK, N.D.

[Abstract] Catalytic reforming over polymetallic catalysts requires preliminary hydrofining so that the sulfur and chlorine contents do not exceed 1 mg/kg. Cases have occurred at some refineries where the chlorine content in straight-run gasolines was as high as 2000 mg/kg as a result of using organic-chlorine compounds during production. Experience at reforming plants shows that dual hydrofining of crudes to remove both sulfur and chlorine often results in insufficient chlorine removal, and this deactivates the catalyst and corrodes the equipment. In the present work a study of the effects of chlorine and sulfur concentration shows that the drop in catalyst activity is due to the development of hydrocracking reactions. An alumina-cobalt-molybdena catalyst showed high activity in hydrogenolysis of organic-chlorine compounds. References 6: 5 Russian, 1 Western.  
[24-12765]

UDC 547.298.4:621.892.86

SYNTHESIS AND STUDY OF FORMAMIDES AND THIOFORMAMIDES AS LUBE OIL ADDITIVES

Leningrad ZHURNAL PRIKLADNOY KHIMII in Russian Vol 57, No 8, Aug 84  
(manuscript received 1 Jul 83) pp 1835-1838

KULIYEV, A.B., ABDULLAYEVA, M.I. and AKHADOV, N.O., Institute of Additive Chemistry, AzSSR Academy of Sciences

[Abstract] Previous work showed that aromatic thiocarboxylic acid amides are effective as lube oil additives. In the present work thioformamides were synthesized by reaction of formamides with phosphorus pentasulfide and their effects on the quality of lube oils studied. With N,N'-dibutylformamide as an example, it is concluded that aliphatic formamides have poor anti-corrosion

and anti-pitting properties, but good anti-wear properties. Thioformamides are effective as anti-corrosion additives to DS-11 oil. The superior anti-corrosion and anti-wear properties of thioformamide in comparison to formamide is attributed to the presence of a sulfur atom in place of an oxygen in the molecule. Thioformamides are somewhat superior to thiobenzomorpholine in anti-corrosion properties and similar to it in anti-wear properties. References 5 (Russian).

[24-12765]

UDC 665.751.074.3

#### INDUSTRIAL EVALUATION OF NEW STEAM PURIFICATION PROCESS OF NATURAL GAS FROM METHANE HOMOLOGS IN PRODUCTION OF CHLOROMETHANE

Kiev KHIMICHESKAYA TEKHNLOGIYA in Russian No 5, Sep-Oct 84 (manuscript received 22 Apr 83) pp 3-5

PLOTNITSKIY, R. A., DYACHKOV, A. I., FEFER, A. G. and MESHENKO, N. T.,  
Institute of Gas, UkSSR Academy of Sciences

[Abstract] The low temperature steam purification process for the removal of various impurities from natural gas is discussed. The process is based on selective conversion of methane homologs in presence of active nickel catalyst to methane and  $\text{CO}_2$ . The process consists of two stages: first  $\text{CO}_2$  and hydrogen are produced, then methane and water are formed. The process is practically irreversible. This process was evaluated on industrial scale using the equipment for destructive hydrogenation modified with a system for steam regulation. The results were satisfactory, yielding a purified gas with about 0.25-0.35% of ethane as an impurity. The chlorination products of thus-purified methane correspond to standards of quality. Figures 2; references 7 (Russian).

[30-7813]

UDC 541.124:66.011

#### INVESTIGATION OF GASOLINE HYDROCRACKING PROCESS ON MODELS OF CONTINUOUS COMPOSITION

Kiev KHIMICHESKAYA TEKHNLOGIYA in Russian No 5, Sep-Oct 84 (manuscript received 10 May 84) pp 8-9

MIKSHINA, V. S., MARTYNYENKO, V. G. and TAGANOV, I. N.

[Abstract] In previous studies a model of continuous composition was proposed for catalytic reforming of gasoline and hydrocracking of alkane mixtures; presently in a system of principal hydrocarbons present in gasoline fraction, reactions of hydrocracking, isomerization, hydrogenation with ring opening and dialkylation were considered. The kinetic model is represented as a

system of six integrodifferential equations representing concentration changes of 33 individual components of gasoline. Initially, the 105-180°C fraction of gasoline contains C<sub>7</sub>-C<sub>10</sub> isoparaffin hydrocarbons; as the reaction proceeds, the C<sub>4</sub>-C<sub>6</sub> hydrocarbons increase; the maximum of the composition curve shifts towards the light products. The content of isoparaffins increased with hydrogenation of cycloparaffins as well as with isomerization of n-paraffins. An increase in the pressure had a positive effect on hydrocracking and dealkylation reactions. The results of this study could be used to demonstrate the utilization of this approach to modelling of multicomponent processes and the hydrocracking processes combined with selectoforming and isoreforming ones. Figures 3; references 6: 5 Russian, 1 Western.  
[30-7813]

UDC 661.715.342

EFFECT OF SULFUR CONTAINING COMPOUNDS ON PROPERTIES OF N-METHYLPYRROLIDONE (N-MP) AND QUALITY OF ACETYLENE

Kiev KHIMICHESKAYA TEKHNLOGIYA in Russian No 5, Sep-Oct pp 12-13

SERDYUK, A. V. and DUKHAN, L. A.

[Abstract] When natural gas with high sulfur content is used in pyrolysis, the acidity of the gases increases, lowering the selectivity of the solvent and decreasing the quality of acetylene because of increased levels of sulfur impurities. The acidity of N-methylpyrrolidone in production of acetaldehyde was varied in the range of 10-30 mg·eq/l. It was shown that the acidity of the solvent was related to the content of sulfur impurities. These impurities could be removed from the solvent at the stage of its regeneration. In order to avoid these problems, the gas used in production of acetylene should contain less than 40 mg/m<sup>3</sup> of sulfur impurities.  
[30-7813]

UDC: 541.128:547.562.1:547.313.4

ALKYLATION OF PHENOL BY ISOBUTYLENE IN PRESENCE OF VANADIUM COMPOUNDS ON  $\gamma$ -Al<sub>2</sub>O<sub>3</sub>

Leningrad ZHURNAL PRIKLADNOY KHIMII in Russian Vol 57, No 9, Sep 84  
(manuscript received 14 Feb 83) pp 2016-2020

KORENSKIY, V. I., KOLENKO, I. P., SKOBELEVA, V. D. and VOLKOV, V. L.,  
Institute of Chemistry, Ukrainian [?] Science Center, USSR Academy of Sciences

[Abstract] A study is presented at the alkylation of phenol by isobutylene over  $\gamma$ -Al<sub>2</sub>O<sub>3</sub> containing vanadium compounds under conditions of formation of phenolate structures on the catalyst surface. Vanadium compounds used were V<sub>2</sub>O<sub>5</sub> and VOSO<sub>4</sub> applied to  $\gamma$ -Al<sub>2</sub>O<sub>3</sub> with particle size 1-1.6 mm.

Alkylation was performed in a glass reactor equipped with a bubbler and stirrer containing 10 g of phenol and 5-8 g of catalyst. The temperature of the experiments was varied from 80 to 150°C, time 6 to 17 hours. The result is, 2,4-di-TBP, produced with high yield. IR spectroscopy confirms the formation of phenolate structures on the surface of the  $V_2O_5$ . The nature of kinetic curves indicates hindered desorption of alkylation products due to relatively strong adsorption of phenols on the surface of the catalyst. Figures 2, references 10: 8 Russian, 2 Western.  
[34-6508]



UDC: 547.245'8.35

ATrans, PART 58: 1-AROXYMETHYLSILATRANS

Leningrad ZHURNAL OBSHCHEY KHIMII in Russian Vol 54, No 9, Sep 84 (manuscript received 5 Dec 83) pp 2017-2020

VORONKOV, M. G., CHERNOV, N. F., FLORENKOVA, O. N., BARYSHOK, V. P.,  
KUZNETSOVA, E. E., MALKOVA, T. I., PUSHECHKINA, T. Ya. and TOKAREVA, L. I.  
Irkutsk Institute of Organic Chemistry, Siberian Department, USSR Academy of  
Sciences

[Abstract] Continuing their study of the influence of the nature of the group separating the aryl group and the silatran heterocycle on the biologic activity of silatrans, the authors synthesized a number of previously-unknown 1-aroxyethylsilatrans. The compounds are colorless, crystalline substances easily soluble in chloroform, dimethylsulfoxide and dimethylformamide, with some solubility in benzene, ether and little in alkanes. PMR and IR spectra, toxicity and bacteriostatic activity for strains of *Staphylococcus aureus*, *E. coli* and *Ps. aeruginosa* are studied. The toxicity of the para-substituted 1-aroxyethylsilatrans increases with increasing  $\sigma$  acceptor or  $\gamma$ -donor properties of the substituent. 1-(4'-iodo-, 1-(3',5'-dichloro- and 1(4'-chlorophenoxyethyl)silatrans have bacteriostatic activity for *Staphylococcus aureus*. References 10: 8 Russian, 2 Western.  
[32-6508]

CLASSIFICATION OF ULTRAFILTRATION MEMBRANES BY EFFECTIVE THICKNESS OF SELECTIVE LAYER

Moscow KOLLOIDNYY ZHURNAL in Russian Vol 46, No 5, Sep-Oct 84 (manuscript received 5 May 83) pp 980-985

CHERKASOV, A.N., ZHEMKOV, V.P., POLOTSKIY, A.Ye., IVANOV, N.B. and POTOKIN, I.L., All-Union Scientific Research Institute of Especially Pure Biocompounds, Leningrad

[Abstract] Retention curves for 43 ultrafiltration membranes were calculated on a Wang-2200. A log-log graph relating permeability of these membranes to their nominal molecular-weight limit allowed them to be grouped based on thickness of their selective layers, a universal structural parameter of membranes. It also allowed easy association of membranes by their retention capability or their capacity. Membrane porosity could be determined by transmission electron microscopy, the effective thickness of the selective layer could be calculated from this value. Calculations were also made for the dynamic membrane formed by viral protein particles during the course of a filtration run. Using this approach, data on the structure and working characteristics of a membrane might be used to decide its preferred use and effectiveness in process applications. Figures 4; references 13: 7 Russian, 6 Western.  
[46-12672]

## POLYMERS AND POLYMERIZATION

### BRIEFS

**HYGIENIC POLYMER**--Fire is not a fearful thing to the polymer created by scientists at the Institute of General and Inorganic Chemistry of the Belorussian Academy of Sciences. "Plastics, even if they do not ignite at high temperatures, decompose, discharging poisonous gases," says Belorussian SSR Academy of Sciences Corresponding Member I. Yermolenko. "It is precisely this which has prompted us to develop a non-combustible, non-toxic artificial material. The absence of matter dangerous to the human body allows the use of the new item in medicine and the food industry." The plastic is already being turned out by industry. Its cost is no higher than that of ordinary plastics. [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 20 Oct 84 p 2] 12614

UDC 541(64+14) :547.245

SILICON AND GERMANIUM PEROXIDE-MEDIATED PHOTOPOLYMERIZATION OF VINYL MONOMERS

Moscow VYSOKOMOLEKULYARNYYE SOYEDINENIYA in Russian Vol 26, No 9, Sep 84  
(manuscript received 3 Jan 83) pp 1795-1800

RAZUVAYEV, G.A., TROITSKIY, B.B., TROITSKAYA, L.S., ZVEREVA, Ye.V., SPIRIDONOVA, M.I., MARGAYEV, A.A., BREVNOVA, T.N., SEMENOV, V. V., CHESNOKOVA, T.A. and BASOVA, G.V., Institute of Chemistry, USSR Academy of Sciences

[Abstract] The effects of various silicon and germanium peroxides on photopolymerization of methyl methacrylate, butyl acrylate and styrene were studied under conditions of exposure to 320-400 nm light of  $1.2 \times 10^{16}$  hv/cm<sup>2</sup>·sec intensity. With the wavelength employed, the extinction coefficients of the peroxides were more than ca. 40-times greater than of the monomers, suggesting the following reaction mechanisms for the initiation of photopolymerization:  $R_3SiOOR' \xrightarrow{h\nu} [R_3SiOOR']^* \rightarrow R_3SiO\cdot + \cdot OR'$ . The rate of photopolymerization differed little among the various peroxides, as indicated by the fact that the rate differs more than 1.7-fold in the case of methyl methacrylate, or 2.2- fold for butyl acrylate. The thermostability of polymethyl methacrylate samples obtained with trimethylcumylperoxisilane exceeded that of samples obtained with di-(tert-butyl)peroxide, and was even further improved by using trimethylcumylperoxisilane with addition of trichlorosilane. Figures 5; references 9: 8 Russian, 1 Western.  
[19-12172]



# THERMAL CYCLODEHYDRATION OF POLYHYDRAZIDE ACIDS IN SOLID PHASE WITH RESIDUAL SOLVENT AND IN SOLUTION

Moscow VYSOKOMOLEKULYARNYYE SOYEDINENIYA in Russian Vol 26, No 9, Sep 84  
(manuscript received 17 Jan 83) pp 1809-1815

SEMEANOVA, L.S., LISHANSKIY, I.S., ILLARIONOVA, N.G. and MIKHAYLOVA, N.V.,  
Institute of High Molecular Weight Compounds, USSR Academy of Sciences

[Abstract] IR spectroscopy and determinations of optical rotation and circular dichroism were used in analyzing the course of thermal cyclodehydration of the polyhydrazide acids (IR,2R)-trans-1,2-cyclopropane dicarboxylic acid and pyromellitic and 3,3',4,4'-diphenyloxidetetracarboxylic dianhydrides under solid-phase (thin film) conditions with residual solvents, and in solution. The results showed that in solid-phase and in pyridine solutions the reactions proceeded with the immediate formation of polyamidoimides. Different reaction mechanisms prevailed in amide solvents and dimethyl sulfoxide, in which there was formation of isoimide fragments as an intermediate step and subsequent isomerization into imide rings. Since cyclodehydration of o-hydrazide groups, which leads to the formation of imide rings, is analogous to cyclodehydration of o-amido acids, it appears that in both cases the identical reaction mechanisms are involved. Figures 6; references 15: 9 Russian, 6 Western.  
[19-12172]

# CRITICAL EVENTS IN INELASTIC DEFORMATION OF GLASSY POLYMERS IN ADSORPTIVE MEDIUM

Moscow VYSOKOMOLEKULYARNYYE SOYEDINENIYA in Russian Vol 26, No 9, Sep 84  
(manuscript received 2 Mar 83) pp 1842-1847

SHITOV, A.N., LUKOVKIN, G.M., VOLYNSKIY, A.L. and BAKYEV, N.F.,  
Moscow State University imeni M.V. Lomonosov

[Abstract] An analysis was conducted on the critical events of inelastic deformation in the glassy polymer PETP [sic] in response to stretching in n-butanol, n-heptanol, n-decanol, or ethylene glycol. On stretching, the regions of low density gave rise to crazing. If there is sufficient time for crazing across the cross-section of the film, stress is eliminated before the flow limit is reached, and, if not, cracking takes place. The key factors affecting the transition of the glassy polymer into a highly dispersed state on stretching are the surface activity of the solvent, its viscosity, the geometric characteristics of the polymer, and the rate of induced deformation. These processes and the consequences of stretching can be defined in terms of Lazurkin's classical equation relating the rate

of deformation to the energy of activation. Figures 3; references 11: 8 Russian, 3 Western.  
[19-12172]

UDC 541.64:539.3

**EFFECTS OF TRIAZINE COMPONENTS ON PHYSICOCHEMICAL PROPERTIES OF  
POLYBUTADIENE:URETHANE BLOCK COPOLYMERS**

Moscow VYSOKOMOLEKULYARNYYE SOYEDINENIYA in Russian Vol 26, No 9, Sep 84  
(manuscript received 26 Mar 83) pp 1877-1881

BEFSONOVA, N.P., KORIGODSKIY, A.R., KUTEPOV, D.F. and GODOVSKIY, Yu.K.,  
Scientific Research Physicochemical Institute imeni L. Ya. Karpov

[Abstract] Calorimetric and physico-mechanical studies were conducted on the effects of triazine and oligobutadiene diols on the characteristics of polybutadiene: urethane block copolymers. The calorimetric studies pointed to the heterogeneity of the copolymers on the basis of glassy transition of the rigid and flexible blocks. These values agreed with the  $T_g$  of the two constituent components, i.e., triazine-containing diols and 4,4'-diphenylmethane diisocyanate which constituted the rigid block, and oligobutadiene diols which represented the flexible block. This fact indicated complete phase separation of the two components, and the fact that the ratio of the elastic to the rigid blocks determined the overall properties of the entire copolymer. Copolymers with less than 50% w/w of the rigid blocks show typical thermoelastic characteristics, including the entire complex of hysteretic phenomena in accordance with the Mallins-Patrikeyev effect. The rigidity attributable to the triazine diols was apparently due to formation of additional hydrogen bonds in which the polar heterocyclic triazines participated. Replacement of the aromatic diisocyanate by the aliphatic 1,6-hexamethylene diisocyanate resulted in increased flexibility. Figures 3; references 6: 4 Russian, 2 Western.  
[19-12172]

UDC 541.64:547.1'128

**EFFECTS OF TRIMETHYLSILANOL ON HEXAMETHYLCYCLOTRISILOXANE POLYMERIZATION  
BY SODIUM TRIMETHYLSILANOLATE**

Moscow VYSOKOMOLEKULYARNYYE SOYEDINENIYA in Russian Vol 26, No 9, Sep 84  
(manuscript received 29 Mar 83) pp 1882-1887

KOPYLOV, V.M., PRIKHOD'KO, P.L., KOVYAZIN, V.A. and DUBCHAK, I.L., Moscow  
Institute of Fine Chemical Technology imeni M.V. Lomonosov

[Abstract] Thermodynamic and kinetic studies were conducted on the polymerization of hexamethylcyclotrisiloxane (D3) by sodium trimethylsilanolate

(NTMS), as affected by trimethylsilanol (TMS). The course of the reaction was followed by GLC. As the molar ratio  $[TMS]_0:[NTMS]_0 = \alpha$  increased, the activity of NTMS increased. With  $\alpha = 0, 0.2, 0.52$  and  $1.5$ , the energies of activation increased from  $61 \pm 7$  kJ/mole, to  $71 \pm 8, 75 \pm 8$ , and  $77 \pm 8$  kJ/mole, respectively. As  $\alpha$  increased from 0 to 15 in value, the  $k_{D3}$  increased more than 30-fold in the temperature range of 50 to 80°C, with the most pronounced rate increase occurring when  $\alpha$  was varied from 2 to 5. The effects of TMS were ascribed to dissociation of the NTMS complexes and the formation of associations between TMS and NTMS, leading to direct interaction with D3 and the polymerization products. Figures 4; references 11: 8 Russian, 3 Western.  
[19-12172]

UDC 541.64:532.78

#### EFFECTS OF DISPERSED FILLERS ON POLYCAPROAMIDE CRYSTALLIZATION KINETICS

Moscow VYSOKOMOLEKULYARNYYE SOYEDINENIYA in Russian Vol 26, No 9, Sep 84 (manuscript received 29 Mar 83) pp 1888-1892

MALKIN, A.Ya., BOLGOV, S.A. and BEGISHEV, V.P., Institute of Continuum Mechanics, UNTs [Ural Science Center?], USSR Academy of Sciences; Scientific-Industrial "Plastmassy" Association

[Abstract] Isothermic conditions were employed to study the effects of dispersed fillers, molybdenum sulfide or graphite, on crystallization kinetics of polycaproamide obtained by anionic polymerization of  $\epsilon$ -caprolactam. The calorimetric studies at 190°C demonstrated that, under the experimental conditions, the fillers had virtually no effect on the rate of polymerization, but that the rate of crystallization was significantly affected. With 0.5 to 10% w/w degree of filling, the rate of crystallization was enhanced at the lowest degree of filling, but prolonged at the higher values. Analysis of the kinetic data showed that autocatalytic-type kinetics [Malkin, A. Ya., et al., Inzhenerno-Fizicheskiy Zh., 44(5):823, 1983] described the experimental data better than the standard Avrami equation. Figures 5; references 4 Russian.  
[19-12172]

## PHOTOELASTICITY OF ORIENTED POLY(METHYL METHACRYLATE)

Moscow VYSOKOMOLEKULYARNYYE SOYEDINENIYA in Russian Vol 26, No 9, Sep 84  
(manuscript received 29 Mar 83) pp 1893-1897

CHISTYAKOV, Ye.V., ARKHIREYEV, O.S. and ZUYEV, B.M., Institute of Organic and Physical Chemistry imeni A.Ye. Arbuzov, Kazan Branch, USSR Academy of Sciences

[Abstract] Photoelastic characteristics of poly(methyl methacrylate) (PMMA) were evaluated from the birefringence data for uniaxially oriented PMMA samples stretch-stressed to 60-300%. The optical sensitivity of instantaneous deformation had a negative sign and was directly related to the degree of stretch. Determinations of the energies of activation revealed two different mechanisms, one of which predominated at temperatures below 233 °K and had an energy of activation of 3 kJ/mole, and another at temperatures above 233°K with an activation energy of 6.3 kJ/mole. The skeletal backbone of PMMA, therefore, can be described by relatively small positive anisotropy of polarizability. Structural characteristics of PMMA and the physical determinants of side fragment interactions determine the negative difference in the pathway on elastic deformation of PMMA. Figures 3; references 5 (Russian).

[19-12172]

UDC 541.64:547.244

## SYNTHESIS AND PROPERTIES OF CARBORANE POLYARYLACETYLENES

Moscow VYSOKOMOLEKULYARNYYE SOYEDINENIYA in Russian Vol 26, No 9, Sep 84  
(manuscript received 31 Mar 83) pp 1898-1902

KIRILENKO, Yu.K., PLYASHKEVICH, L.A., SHITIKOV, V.K., KALININ, V.N., KUDRYAVTSEV, G.I., SERGEYEV, V.A., ZAKHARKIN, L.I. and PARFENOV, B.P., Scientific-Production Association "Khimvolokno"; Institute of Heteroorganic Compounds imeni A.N. Nesmeyanov, USSR Academy of Sciences

[Abstract] Experimental conditions are described on the polymerization of p(o-carboranyl)phenylacetylene and its copolymerization with p-diethynylbenzene in aromatic solvents (benzene, toluene or p-xylene) in the presence of the triphenylphosphine-nickel acetyl acetonate (TPP-NAA) catalytic system. With initiation of the polymerization reaction by TPP-NAA maximum yields of polymerization were obtained p-xylene (92.5%), while maximum copolymer yields (93%) were obtained with the same catalytic system with a p-diethynylbenzene:p-(o-carboranyl)phenylacetylene ratio of 2:1. IR spectral data on the polymers and copolymers are presented, and the different absorption bands analyzed in terms of the various bonds and groups. Thermo-mechanical observations indicated that the copolymers retained residual plasticity at >300°C. Figures 2; references 7: 5 Russian, 2 Western.

[19-12172]



## MECHANICAL DEGRADATION OF SILK FIBROIN AT 77°K

Moscow VYSOKOMOLEKULARNYE SOYEDINENIYA in Russian Vol 26, No 9, Sep 84  
(manuscript received 4 Apr 83) pp 1903-1907

L'VOV, K.M., GASYMOV, O.K. and MAMEDOV, Sh.V., Institute of Chemical Physics, USSR Academy of Sciences; Institute of Physics, Azerbaijan SSR Academy of Sciences

[Abstract] Determinations were made of the chemical bonds involved in scissor maceration of silk fibroin at 77°K under weak illumination, in view of the susceptibility of free radicals to light. At the temperature of liquid nitrogen employed, the probability of secondary radical reactions is markedly diminished, as is the formation of peroxide-type radicals. Assessment of the ESR spectra and of the effects of 330-390 nm illumination indicated that the primary bond rupture involves C $\alpha$ -C bonds, constituting the backbone of the peptide chain. Concomitantly, -NH-C $\alpha$ HR and CO-NH- radicals are formed, and are subject to phototransformation. Significant rupture of other bonds does not occur. Figures 3; references 20: 15 Russian, 5 Western.

[19-12172]

UDC 541(64+14+15):539.2

## PHOTO- AND RADIOPOLYMERIZATION OF N-PHENYLMALIMIDE MONOCRYSTALS: MOLECULAR AND CRYSTALLINE STRUCTURE

Moscow VYSOKOMOLEKULARNYE SOYEDINENIYA in Russian Vol 26, No 9, Sep 84  
(manuscript received 8 Apr 83) pp 1920-1928

GORDON, D.A., MIKHAYLOV, A.I., BARKALOV, I.M., PONOMAREV, V.I., FILIPENKO, O.S. and ATOVMYAN, L.O., Department, Institute of Chemical Physics, USSR Academy of Sciences

[Abstract] Description is provided of the techniques of UV- and radiopolymerization of N-phenylmalimide monocrystals, and the results of various studies on the molecular and crystalline features at room temperature and 77°K. The results showed that both forms of polymerization result in the formation of oriented polymers up to a 50% degree of conversion, with the polymers extended along the long axis of the crystal. Tabular data are presented on the coordinates and anisotropic thermal parameters of the nonhydrogen atoms, coordinates of hydrogen atoms, bond lengths, valence angles, and so forth. As the degree of conversion increases, birefringence is lost, indicating that the samples become amorphous. The average kinetic length of the polymerization chain was calculated as  $\bar{\nu} = 1250$  (300°K) for gamma-irradiation. Figures 6; references 9 (Russian).

[19-12172]

## SYNTHESIS AND PROPERTIES OF THERMOREACTIVE POLYAMINOMALEINIMIDES

Moscow VYSOKOMOLEKULARNYE SOYEDINENIYA in Russian Vol 26, No 9, Sep 84  
(manuscript received 11 Apr 83) pp 1936-1943

SERGEYEV, V.A., NEDEL'KIN, V.I., YUFEROV, Ye.A., YERZH, B.V., KOMAROVA, L.I.,  
BAKHMUTOV, V.I. and TSYRYAPKIN, V.A., Institute of Heteroorganic Compounds  
imeni A.N. Nesmeyanov, USSR Academy of Sciences; Kemerovo Scientific-  
Production Association "Karbolit"

[Abstract] Thermoreactive polyaminomaleinimides (PAMI) were synthesized in dioxane at 180°C by the addition of 4,4'-diaminodiphenylsulfide to N,N'-(4,4'-diphenylsulfide)-bis-maleinimide, and under melt conditions at 120°C in tricresol by addition of 4,4'-diaminodiphenylmethane to N,N'-(4,4'-diphenylmethane)-bis-maleinimide. X-ray, IR, ESR and optical density determinations demonstrated that PAMI obtained in solution consisted of high-melting crystalline products, while under melt conditions amorphous oligomers are synthesized. The  $T_m$  for the former PAMI products are on the order of 170-175°C, about 80°C higher than for the amorphous PAMI. Tabular data are presented on the viscosity characteristics,  $T_m$  values, gelling time,  $NH_2$  concentration, yields, and chemical composition. Each of the PAMI represented a thermoreactive product; their structural features were determined both by C=C bonds of the maleinimide rings and the opening of succinimide rings with the formation of aliphatic amide groups. Figures 5; references 14: 9 Russian, 5 Western.

[19-12172]

UDC: 535.37

## LUMINESCENCE OF SINGLET OXYGEN IN POLYMER FILMS

Leningrad ZHURNAL PRIKLADNOY KHIMII in Russian Vol 57, No 9, Sep 84 (manuscript received 4 May 83) pp 2081-2086

BYTEVA, I.M., GURINOVICH, G. P., GOLOMB, O. L. and KAKPOV, V. V., Institute of Physics, Belorussian SSR Academy of Sciences

[Abstract] For the first time, sensitization of natural luminescence of oxygen in polymer films by dyes was recorded. Studies were performed in polyester, polyamide, triacetate and cellophane films 0.001-0.003 cm thick. The films were treated using dyes capable of sensitizing oxygen in solution, plus porphyrins which have near unit quantum yield in the triplet state and a rather long life in the excited state, making them good model compounds for the study of processes of formation of singlet oxygen. The dyes were introduced to the films by a high temperature method at 130°C in autoclaves. The films could not be successfully stained by porphyrins by this method, so they were introduced to the polymer matrix by placing the

pigment powder between two films and heating them to 180°C under moderate pressure. The luminescence of the singlet oxygen was observed in polyester films stained with porphyrins, tryptoflavin, anthraquinone and still dies. Vacuum treatment of the films for 2 to 3 hours causes disappearance of luminescence, which was restored if the films were held in air for 1 to 1 1/2 hours. The experimental data indicate that dissolved oxygen is luminescing in the films. The discovery of photoluminescence of O<sub>2</sub> is a direct proof of the formation of singlet oxygen in dyed polymer materials. Figure 1; references 26: 20 Russian, 6 Western.  
[34-6508]

UDC 661.882:678.044:678.674

#### NOVEL TITANIUMORGANIC CATALYSTS FOR TRANSESTERIFICATION AND POLYCONDENSATION

Moscow PLASTICHESKIYE MASSY in Russian No 10, Oct 84 pp 6-8

KHRUSTALEVA, Ye.A., KOCHNEVA, M. A., FRIDMAN, L. I., LUNDINA, V. G.,  
SUVOOROV, A. L., TARASOV, A. I., ALEKSEINA, V. D. and KURNIKOVA, L. I.

[Abstract] A series of new titanium and titanium-silicon organic compounds -- effective transesterification and polycondensation catalysts -- was obtained: bis(chelate)bis(triethylsiloxo)titanates, bis(chelate)bis(hydroxyalkoxy)titanates and bis(chelate)bis(oligoester)titanates. Their catalytic activity in synthesis of polyethyleneterephthalate was investigated. It was shown that all three titanate catalysts were effective transesterification and polycondensation catalysts. They are active in very low concentrations making it possible to obtain the final products with an insignificant content of the metal impurity. References 12 (Russian, 4 by Western authors).  
[49-7813]

UDC 678.742.2:537.311:66.085.3

#### ELECTROCONDUCTIVITY OF RADIATION MODIFIED COMPOSITIONS PEVD CONTAINING TECHNICAL CARBON

Moscow PLASTICHESKIYE MASSY in Russian No 10, Oct 84 pp 13-16

BARSUKOV, V. M., DIKERMANN, D. N. and FINKEL', E. E.

[Abstract] Electroconducting polymer compositions are widely used in modern technology. One of the more important applications is in the field of cables with low level of electric noise used in control and protective systems of atomic reactors. Polymer compositions were developed for this purpose based on a mixture of polyolefines, some elastomers, technical carbon and various additives. The effect of the composition of such systems and the interrelationship among the ingredients on the properties of the end products was

investigated. The specific volume electric resistance was shown to drop gradually with an increased content of technical carbon; temperature elevation from 90 to 100°C led to a slightly increased resistance which reached a maximum at about 115°C. The results were analyzed on the basis of a physical model proposed in other studies. Figures 3; references 8: 7 Russian (1 by Western author), 1 Western.  
[49-7813]

UDC 678.743.21:678.048

#### COMPATIBILITY OF POLYVINYLFLUORIDE WITH THERMOSTABILIZERS

Moscow PLASTICHESKIYE MASSY in Russian No 10, Oct 84 pp 16-17

MUKHIDDINOV, B. F., GAFUROV, A. Kh., ASAMOV, M. K. and ABDUSHUKUROV, A. K.

[Abstract] Relative compatibility of polyvinylfluoride (PVF) with different thermostabilizers was studied comparing their evaporation rates in pure state and in composition. The following stabilizers were evaluated: diphenylamine, N,N'-diphenylguanidine, N-acetyldiphenylamine, N-phenyl-2-naphthylamine, 2-phenyl-2'-naphthylamine, 3-chloro-6-methylphenyl-3'-chlorophenoxymethyl ketone and 3-chloro-6-methylphenyl-4'-chlorophenoxymethyl ketone (p-CMC). The evaporation rate of pure amine derivatives depended on the positions of phenyl radicals and their substituents in respect to the amine group; in case of the phenoxymethyl ketone chlorides, the chlorine atom position had no effect on the volatility. All stabilizers exhibited lower volatility in compositions than in the pure state. Comparison of the compatibility of amines with PVF showed that it decreased with replacement of the hydrogen atom by an acetyl group or by introduction of a phenyl group. Among the phenoxymethyl ketone derivatives, the highest compatibility was shown by p-CMC. Introduction of stabilizers increased thermal stability of PVF; their effectiveness was directly related to their compatibility with the polymer. Figures 2; references 8 (Russian).  
[49-7813]

UDC 678.5.4:539.4

#### MECHANISM OF STRENGTHENING PLASTICS WITH RUBBERS

Moscow PLASTICHESKIYE MASSY in Russian No 10, Oct 84 pp 21-22

KULEZNEV, V. N.

[Abstract] The mechanism of strengthening various plastics with rubber particles has not been adequately studied. In the present paper a short review of prevailing concepts on this subject was given. Plastics resistant to impact contain dispersed rubber particles in a matrix of brittle plastic



mass. The reinforcing action of the rubber is explained by the fact that a filler particle represents a concentrator of stress leading to microcracks filled with oriented polymer of the matrix. The role of the elastic filler, however, has not been adequately explained. The deformation of a sample on impact results in an appearance of overstress at the equatorial zone of a rubber particle. The rubber filler affects the brittle matrix of a plastic material by relieving plastic (forced elastic) deformation in presence of tensions concentrated around the particle. References 5 (Russian, 3 by Western authors).  
[49-7813]

UDC 678.742.2.033.01

#### EFFECT OF MODIFYING ADDITIVES ON PROPERTIES OF FILLED HPPE

Moscow PLASTICHESKIYE MASSY in Russian No 10, Oct 84 pp 24-26

KERBER, M. L., RUSIN, D. L., GRIGOR'YEVA, L. K. and SAMORODOVA, N. A.

[Abstract] Regulations of the properties of filled high pressure polyethylene (HPPE) [PEVD] were studied in an attempt to develop methods for its extrusion processing under conditions of side sliding which require that the material be highly cohesive with low coefficient of internal friction. Therefore the relationship between friction force of filled HPPE and various factors was investigated in depth looking for ways of lowering it by addition of the following agents: zinc stearate, a complex ester of glycerine and stearic acid, and a simple oligoester OOPG-1000. Experiments showed that all of them lowered the specific friction force of HPPE even at low concentrations (0.5%-1.5%) of the additive; further increases of the additive had no additional effect on the friction force. A temperature elevation from 353 to 383 K lowered the friction force of all materials studied. It was thus shown that modification of HPPE with above additives improved its properties, facilitated its processing methods and lowered consumption of energy for these processes. Figures 2; references 7 (Russian).  
[49-7813]

UDC 678.5:62-634.5

#### PLASTICS FROM PLANTS

Moscow PLASTICHESKIYE MASSY in Russian No 10, Oct 84 pp 32-35

MOSKATOV, K. A.

[Abstract] The utilization of plastics increases continuously. The long range plans for development of polymer chemistry include the possibility of obtaining plastics from plants. The sources for this include wood

cellulose, cotton, millet, grape vine and others. The wood cellulose is an excellent source of furfural, phenol etc. Natural fibers can be used as reinforcing agents for thermoplastics and thermoreactive materials. At present there is a paucity of new programs aimed at production of new materials based on natural products. The expansion of the production of plastics from plant sources will depend on the advances in the technology of cellulose processing. The second component in terms of priorities is lignin. Several methods were developed for production of highly dispersive filler from hydrolyzed lignin. Recently, water-soluble phenol lignin-formaldehyde resins were obtained. Creation of new plastics based on plant resources will expand the assortment of polymers based on readily available starting materials requiring minimal energy consumption for their production. References 16: 7 Russian (4 by Western authors), 9 Western.  
[49-7813]

UDC 678.744.335.06:666.26:628.9

#### POLYMETHYLMETHACRYLATE LIGHT DISPERSING ORGANIC GLASS

Moscow PLASTICHESKIYE MASSY in Russian No 10, Oct 84 p 62

MURAV'YEVA, T. M., PUZANOVA, I. V., ROSLYAKOVA, V. A., YEMEL'YANOV, D. N., NAZAROVA, D. V., GUR'YANOVA, O. G. and SOBOLEVSKAYA, L. V.

[Abstract] There are many methods of producing light dispersing (white, opaque) polymer materials based on optical heterogeneity of the material. A method was proposed for making polymethylmethacrylate opaque by introduction of polydimethylsiloxane liquid. The method is simple and requires no modification of the equipment. There are some restrictions, however: adequate heat removal (therefore one needs aqueous medium), the molecular weight of the polydimethylsiloxane liquid should be about  $10^3$ . To obtain good quality glass it is necessary to reach, during polymerization, a phase in form of individual inclusions with particle size of at most 1  $\mu\text{m}$ . References 7 (Russian, 1 by Western author).  
[49-7813]

## INVESTIGATION OF ADSORPTION OF SPIN-TAGGED POLYMERS ON E. COLI CELLS

Moscow KOLLOIDNYY ZHURNAL in Russian Vol 46, No 5, Sep-Oct 84 (manuscript received 16 May 83) pp 873-879

GIRFANOVA, T.F., NIKITIN, N.V., NIKOLAYEV, B.P., TESLENKO, A.Ya. and TOROPOV, D.K., All-Union Scientific Research Institute of Especially Pure Biocompounds, Leningrad

[Abstract] A highly-branched polyethylene imine with a low molecular mass ( $3 \times 10^4$ ) and dextran ( $7 \times 10^4$ ) were spin tagged with covalently-bonded nitroxyl radicals (1 marker per 50 units) and added to suspensions of E. coli M-17 ( $2 \times 10^{11}$  cells/ml) at a concentration of 5-10 mg/l. Adsorption parameters were measured by electron paramagnetic resonance. This showed the dextran to be only weakly adsorbed, while the polyethylene imine was fully adsorbed up to 20 mg/l and rapidly reduced by electron transport across the cell membranes. This high adsorption indicated directed diffusion due to electrostatic interaction of the tagged polyethylene imine and the cell walls. Initially, the formation of a loose boundary layer led to the deformation of polymer clusters, allowing more internal segments to react with the cell. Conversely, dextran interaction showed low segmental contact and appeared to be largely due to random Brownian movement. Figures 5; references 17: 9 Russian, 8 Western.  
[46-12672]

## STUDY OF CHARACTER OF ADHESIVE INTERACTION AND BREAKING OF POLYIMID-ALUMINUM FOIL JUNCTION DURING PROCESS OF HARDENING

Moscow KOLLOIDNYY ZHURNAL in Russian Vol 46, No 5, Sep-Oct 84 (manuscript received 27 May 83) pp 961-966

STARTSEV, V.M., CHUGUNOVA, N.F., CHALYKH, A.Ye., KAZANSKIY, L.P., and RUBTSOV, A.Ye., Institute of Physical Chemistry, USSR Academy of Sciences, Moscow

[Abstract] A 10% solution in dimethylformamide of a polyamido acid synthesized from the dianhydride of 3,3',4,4'-benzophenyltetracarboxylic acid and diaminodiphenyl ether was used to form a 50-micron coating on 100-micron aluminum foil. Resulting films were peeled off and the adhesive strength measured. Electron spectrometry of the separated surfaces showed the amount of aluminum remaining on the foil. Cross-sections of foil before and after adhesion were also studied with a scanning electron microscope. At room temperature, the adhesive strength of 680 g/cm was due almost entirely to the physical introduction of the polymer into surface defects of the foil. Breaking the adhesive bond required stretching the polymer from these defect areas and then breaking the "rivet" contacts that had been

formed. At 20-80 C, partial destruction of the polyamido acid resulted in filling even smaller defects and also some possible interaction with freed amino and carboxyl groups; adhesive strength rose to 1340 g/cm. At 80-150 C, active imidization increased the friability of the film and its internal tensions, lowering adhesive strength to its initial level. At 150-230 C, solid-phase imidization further increased friability and weakened the boundary layer. Figures 3; references 9: 8 Russian, 1 Western.  
[46-12672]

UDC: 547.567:541.138

#### SYNTHESIS AND ELECTROCHEMICAL OXIDATION-REDUCTION OF REDOX POLYMERS CONTAINING P-QUINONE GROUPS

Vilnius TRUDY AKADEMII NAUK LITOVSKOY SSR: SERIYA B (KHIMIYA, TEKHNKA, FIZICHESKAYA GEOGRAFIYA) in Russian No 3 (142), May-Jun 84 (manuscript received 4 Feb 83) pp 37-40

POTSYS, A.K., CHENAS, N. K. and KULIS, Yu. Yu., Institute of Biochemistry Lithuanian SSR Academy of Sciences

[Abstract] High molecular weight compounds were synthesized by known methods and a new polymer produced based on polyvinylpyridine and the electrochemical properties of the polymer were studied. Polyhydroquinone (PHQ) was synthesized by anion polymerization of benzoquinone. A copolymer of styrene plus hydroquinone (PSC) was obtained by cation copolymerization of styrene and p-benzoquinone. A copolymer of styrene and acrylamide (PSAC) was modified by formaldehyde and 2-bromohydroquinone. Poly-4-vinylpyridine (PVP) was obtained by radical polymerization of 4-vinylpyridine. Poly-4-vinylpyridine was modified by bromoquinone by incubation of equimolar quantities of poly-4-vinylpyridine and 2-bromoquinone in methanol at 25°C for 24 hours. The redox polymer produced (PVPC) was twice precipitated from benzene. Elemental analysis of the redox polymers synthesized showed that the degree of quaternization of poly-4-pyridine by bromoquinone was 90%, the degree of modification of acrylamide groups by bromohydroquinone in the styrene-acrylamide copolymer reached 85%. The pK of dissociation of hydroxyl groups in the reduced redox polymers was 8.0-8.5. Electrochemical oxidation and reduction of adsorbed redox polymers on electrodes occurred quasireversibly. The rate constant of electrode reactions varied from 0.02 s<sup>-1</sup> (PHQ) to 0.2-0.3 s<sup>-1</sup> (PVPQ) and increased with increasing polymer chain mobility. References 10: 2 Russian, 8 Western.  
[387-6508]



ACTIVATION OF ABS PLASTIC BY NONAQUEOUS  $\text{PdCl}_2$  SOLUTIONS

Vilnius TRUDY AKADEMII NAUK LITOVSKOY SSR: SERIYA B (KHIMIYA, TEKNIKA, FIZICHESKAYA GEOGRAFIYA) in Russian No 3 (142), May-Jun 84 (manuscript received 22 Mar 83) pp 41-46

DOBREVA, Ye. D., YENCHEVA, M. A., LIRKOV, A. L., PETROV, Kh. B., VAYKUTITE, A. Yu. and SHALKAUSKAS, M. I., Higher Machine-Electric Engineering Institute imeni V. I. Lenin (Sofia, Bulgaria); Institute of Chemistry and Chemical Technology, Lithuanian SSR Academy of Sciences

[Abstract] A study is presented of the influence of activation of ABS plastic by ethanol and ethanol-acetone solutions of  $\text{PdCl}_2$  at high temperature on changes in the surface structure, adsorption of complex Pd (II) chloride compounds and bond strength of chemically precipitated nickel coatings. Radiochemical studies indicate the quantity of Pd adsorbed by nonetched and etched surfaces of AB and ABS specimens as a function of time of direct activation by ethanol- $\text{PdCl}_2$  solutions at 20 and 60°C. More Pd is adsorbed by the etched surface than by the unetched surface at 20°C, while at 60°C the reverse is true. The bond strength of the Ni coating to the surface of etched AB plastic decreases with an increase in time of processing by the ethanol- $\text{PdCl}_2$  solution at 60°C due to significant changes in the polymer surface structure. Activation at 60°C with ethanol-acetone- $\text{PdCl}_2$  solutions and unetched AB surface achieves a bond strength of up to 3 kgf/26 mm, while the bond strength achieved with a surface etched by chromic-sulfuric acid solution for 5 minutes at 75°C reaches 3.8 kgf/25 mm. Figures 6; references 5: 2 Russian, 3 Western.

[387-6508]

UDC 678.744.4:66.095.268

## RADIATION HARDENING OF POLYESTER COMPOSITIONS UNINHIBITED BY ATMOSPHERIC OXYGEN

Moscow PLASTICHESKIYE MASSY in Russian No 9, Sep 84 pp 10-12

ZAGORSKAYA, Z.G., MASLOVA, Ye.V., DEYEV, Yu.S., SAPOZHNIKOVA, Ye.L. and MIKHAYLOVA, Z.V.

[Abstract] Studies were conducted on polyester compositions to determine radiation effects in the presence of various acidic modifiers, in terms of solidification and oxygen inhibition. Using styrene (30% v/v) solutions of unsaturated polyesters and irradiation with 5 MeV electrons from a Co-60 source, showed that maximum attenuation of the inhibitory effects of oxygen was obtained with chlorendic anhydride (in the case of polyesters synthesized from maleic anhydride and ethylene glycol). The presence of chlorendic anhydride inhibits the oxygen effect even with low-dose radiation (0.02 MGy)

at room temperature in air, while allowing for 90.0% gel-fraction yield. There is an inverse relationship between the gel-fraction yield and chlorendix anhydride concentrations, but a direct one between the concentration and diminution of the effects of oxygen on radiation-hardened surfaces. Figures 1; references 8: 6 Russian, 2 Western.  
[21-12172]

UDC 678.743.22-13.678.01:539

#### MOLECULAR CHARACTERISTICS OF SUSPENSION AND SOLUBLE VC+VA COPOLYMERS

Moscow PLASTICHESKIYE MASSY in Russian No 9, Sep 84 pp 14-16

KRONMAN, A.G., KOLEGOV, V.I., POTAPOV, V.N., IVANOVA, L.F. CHEKUSHINA, M.A. and SAMARIN, A. F.

[Abstract] Determinations were made of the dispersion characteristics of dissolved and soliquid copolymers of vinyl chloride and vinyl acetate (VC+VA). The tabulated data demonstrated that the degree of homogeneity, composition and the molecular weight are quite similar for both copolymers, with the dispersion data in agreement with that published by others. The polydispersion values ( $M_w/M_n$ ) for both types of preparations were quite similar and in the 1.73-2.06 range, despite the different synthetic approaches employed in each case. Analysis of the compositions and characteristic viscosities indicated that relatively simple synthetic and saponification techniques can be employed to produce soliquid VC+VA copolymers that are on technical par with dissolved VC+VA copolymers. Figures 1; references 14: 5 Russian, 9 Western.  
[21-12172]

UDC 678.82.01

#### OPERATIONAL CHARACTERISTICS OF MODIFIED STRUCTURAL POLYSULFONE

Moscow PLASTICHESKIYE MASSY in Russian No 9, Sep 84 pp 16-17

BEYDER, E.Ya., KANTSEVICH, L.I., SHALAYEVA, L.V., REYTBURD, L.I., SEMENKOVA, A.E. and BOLOTINA, L.M.

[Abstract] PS-B polysulfone modified by thermostable additives was subjected to a variety of chemical and mechanical testing procedures to determine its operational characteristics under a wide variety of conditions. Analysis of the effects of various physical and chemical factors, as well as determinations of tensile strength, tensile modulus, elongation characteristics, impact strength, water absorption, etc., confirmed the high utility of modified PS-N for various structural details. Designated PSA-F-1, the polysulfone is suitable for the manufacture of thermostable structural and electrotechnical components that can be used under a variety of climatic

conditions with temperatures in the -60 to +165°C range. Figures 1; references 3 (Russian).  
[21-12172]

UDC 678.04:[678.742.3:539.4]

#### EFFECT OF TEFLON ON POLYPROPYLENE STRENGTH AND DURABILITY

Moscow PLASTICHESKIYE MASSY in Russian No 9, Sep 84 pp 17-18

YARTSEV, V.P.

[Abstract] Small quantities of Teflon (up to 5%) were added to polypropylene to test its utility in improving wear resistance of the latter. Samples prepared by mixing the two components at 180-200°C were analyzed by a variety of methods to determine the chemical and mechanical characteristics of the product. Study of thermal decomposition curves of the various composites containing 0.5, 2 or 5% Teflon showed that Teflon did not affect the rate of destruction and, therefore, indicated that polypropylene and Teflon did not react chemically. The increased strength and durability of the product was ascribed to Teflon as an active filler. However, the increase in opacity of such samples under pressure and the instability of the melting temperature suggest incompatibility of the two components. Nevertheless, durability was improved in wear studies in the temperature range of 20-60°C, indicating that such compositions should find use in certain processes. Figures 2; references 9 (Russian).  
[21-12172]

UDC 678.74.678.033

#### NEW COMPOSITIONS OF REINFORCED POLYOLEFINS

Moscow PLASTICHESKIYE MASSY in Russian No 9, Sep 84 pp 19-20

ZLOBINA, V.A., RUMYANTSEVA, Ye.I. and LON', L.B.

[Abstract] A brief discussion is presented of new reinforced polyolefins developed to further expand the industrial applications of this category of thermosetting plastics. Tabular data are presented on polyolefins reinforced with asbestos and glass fiber. The asbestos reinforced polyolefins are seen to be particularly suitable for processes that require heat tolerance to 120°C and high hardness. The glass-filled polyolefins have found use in the manufacture of components that have to withstand corrosive chemicals, and in the production of metalloplastic pipes.  
[21-12172]

## EFFECT OF ELECTRIC FIELD ON ACRYLAMIDE+METHYLENEBISACRYLAMIDE COPOLYMER

Moscow PLASTICHESKIYE MASSY in Russian No 9, Sep 84 pp 20-21

KSENOFONTOV, B.S. and KULESHOV, V.V.

[Abstract] Electrophoresis and gas chromatography were employed in analyzing the effects of electric fields on the structure of acrylamide+methylenebisacrylamide copolymer. The reaction mixture consisted of acrylamide and methylenebisacrylamide in borate buffer at pH 8.6, exposed to 50 Hz to 200 kHz electric fields under potentials of 10 to 50 mV/cm. Analysis of the results demonstrated that the effects of the electric field in increasing the degree of polymerization were independent of the voltage, but significantly affected by the time elapsed between the preparation of the reaction mixture and the acrylamide content. Since electric fields can be used to modify the structure of the copolymer, such an approach can be used in the preparation of various other plastics and synthetic flocculants used in water purification. References 6 (Russian).

[21-12172]

## OPERATIONAL CHARACTERISTICS AND FLAMMABILITY OF PHOSPHORUS-CONTAINING RIGID POLYURETHANE FOAMS

Moscow PLASTICHESKIYE MASSY in Russian No 9, Sep 84 pp 21-23

USHKOV, V.A., ASEYEVA, R.M., KALININ, V.I., FILIN, L.G., RUBAN, L.V. and GREKHOVA, T.N.

[Abstract] Various hydroxyethylated phosphorus-containing oligoesters were employed in the synthesis of rigid polyurethane foams to determine their operational characteristics and flammability. Analysis of the resultant products showed that all mechanical and flammability requirements were met by samples containing 2.5-3.0% phosphorus. This was achieved by employing the esters in a quantity equivalent to 50-70% of the mass of the hydroxylated reactants. Limiting the phosphorus to the levels indicated assured low absorption of water, a high elastic modulus, good electrical resistance, and raised the flammability point to ca. 440°C. Figures 3; references 7 (Russian).

[21-12172]



## KINETIC RELATIONSHIPS FOR COMPUTING PROCESS RATE AND MOLE-MASS DISTRIBUTION OF PRODUCTS OF STYRENE-ACRYLONITRILE COPOLYMERIZATION IN PRESENCE OF RUBBER

Leningrad ZHURNAL PRIKLADNOY KHIMII in Russian Vol 57, No 8, Aug 84  
(manuscript received 29 Sep 82) pp 1787-1792

PODOSENOVA, V.G., BUDTOV, V.P. and DOKUKINA, L. F.

[Abstract] Pre-computation of the physical chemical and mechanical properties of materials such as ABS-plastics is difficult due to the many parameters which determine the properties of the product and the process for its preparation. In the present work kinetic relationships were derived for computing the copolymerization velocity of styrene with acrylonitrile in the presence of rubber, and the mole-mass distribution function for the styrene-acrylonitrile matrix. The relationships were then checked by comparison with analysis of products obtained under conditions analogous to industrial. Figures 2; references 14: 11 Russian, 3 Western.  
[24-12765]

UDC 678.02

## STUDY OF EFFECT OF FILLER ON POLYBISMALEIMIDAMINE FORMATION BASED ON N,N'-METAPHENYLENEBISMALEIMIDE AND 4,4'-DIAMINODIPHENYL ETHER

Leningrad ZHURNAL PRIKLADNOY KHIMII in Russian Vol 57, No 8, Aug 84  
(manuscript received 1983) pp 1827-1830

KHABENKO, A.V., KALINCHIKOV, V.Ye., MARINYUK, L.I., RAKHMANOVA, T.V. and DOLMATOV, S.A.

[Abstract] A filler surface may either catalyze or inhibit binder hardening, and changes in chain growth and rupture related to surface interaction frequently causes polymerization at the filler-polymer interface to be more rapid than in the bulk. This should result in observable changes in thermal effects readily detected by differential thermal analysis (DTA). In the present work the effects of three fillers (graphite, fluoroplast-4 and molybdenum disulfide) on the formation of polybismaleimidamine from N,N'-meta-phenylenebismaleimide and 4,4'-diaminodiphenyl ether was studied by DTA and by degree of reaction termination as determined by concentration of amino groups and gel-fraction content. The results show that the filler affects the kinetics of polymer formation by accelerating the cross-linking process. For all fillers studied, this acceleration was found to depend on the volumetric fraction of the filler, and not on its chemical nature or dispersion.  
Figure 1; references 7 (Russian).  
[24-12765]

## BEHAVIOR OF POLYAMIDOIMIDES AT LOW TEMPERATURES

Leningrad ZHURNAL PRIKLADNOY KHIMII in Russian Vol 57, No 8, Aug 84  
(manuscript received 4 May 83) pp 1819-1821

GUSINSKAYA, V.A., CHURGANOVA, S.S., KOTON, M.M., MOSEVICH, A.N., BATRAKOVA, T.V., ROMASHKOVA, K.A., LIKHOLETOV, Yu.V. and RODIONOVA, O.A., Institute of High Molecular Weight Compounds, USSR Academy of Sciences

[Abstract] While it is known that polyurethanes, polyamides, polyimides and polyamidoimides are capable of withstanding temperatures as low as 97-77°K, little is known of the physical chemical and dielectric properties of these polymers at these temperatures. A study of six various polyamidoimide films stored for 24 hours in liquid nitrogen showed that this class of polymers retains its properties at 77°K. Low temperature was even found to somewhat improve the dielectric characteristics, while the deformation-strength properties were unchanged. References 7 (Russian).  
[24-12765]

UDC 532.135:678.01-19

## RHEOLOGICAL PROPERTIES OF FUSED MIXTURES POLYCAPROAMIDE-POLYPROPYLENE

Kiev KHIMICHESKAYA TEKHNLOGIYA in Russian No 5, Sep-Oct 84 (manuscript received 20 May 84) pp 14-16

YAKOVLEV, K. V., ZHITOMIRETS, R. I., ROMANKEVICH, O. V., ZABELLO, S. Ye. and YUDIN, A. V., KTILP [expansion unknown]

[Abstract] The goal of this work was to study rheological properties of fused mixtures of polycaproamide (PCA) and polypropylene (PP). The monofibers obtained from the PCA-PP mixture exhibit a matrix-fibrillar structure. With 5-40% content of PP, the dispersive phase in the stream coming out of the capillary is formed by PP fibers; with a 60-95% PP content -- by PCA fibers and in the 40-60% range, mutually permeable structures of one polymer in another are formed. Formation of fibers from the above mixtures becomes more difficult with increased content of PP; at the point of 40% PP to 60% PCA no fiber can be obtained. This decreased ability to form fibers from the fused mixtures in comparison to pure components was related to the increasing density index anomaly, which in turn was related to the formation of supermolecular structures in these fused mixtures. Figures 3; references 15 (Russian).  
[30-7813]

## PHOTOCHEMICAL SYNTHETIC METHOD FOR OLIGOHYDROXYPROPYLENEGLYCOLS

Kiev KHIMICHESKAYA TEKHNLOGIYA in Russian No 5, Sep-Oct 84 (manuscript received 2 Apr 84) pp 16-18

DEGTYAREVA, A.A., IKhVS [expansion unknown] of the UkSSR Academy of Sciences

[Abstract] In order to improve the synthesis of oligohydroxyalkyleneglycols, photoinitiated reaction of propylene oxide (PO) with diethylene glycol (DEG) was studied at different temperatures, varying ratios of the reaction components and changing light intensity. Triphenylsulfoniumhexafluorophosphate was used as the photoinitiator. The results obtained showed that under the action of UV light on the propylene oxide-diethylene glycol system, in presence of a photoinitiator of cationic polymerization of simple cyclic esters, oligohydroxypropylene glycols are formed whose molecular weight could be controlled by the amount of the glycol used in the initial mixture. The reaction rate increased with increased concentration of the initiator, higher light intensity and increased temperature. This process is energy efficient, avoids heating and occurs under homogeneous conditions. Figures 4; references 6: 5 Russian (1 by Western author), 1 Western. [30-7813]

UDC 678-13.547.584.6.532.135

## RHEOLOGIC PROPERTIES OF PHENYLONE

Kiev KHIMICHESKAYA TEKHNLOGIYA in Russian No 5, Sep-Oct 84 (manuscript received after revision 12 Oct 83) pp 18-20

PAKHARENKO, V. A., PETRUSHENKO, Ye. P., KIRILENKO, Ye. M., KUTS, V. A. and VINOGRADOV, A. V., Ukrainian Scientific Research Institute of Plastics

[Abstract] Rheological properties of C-2 phenylone (a copolymer of m-phenylenediamine and dichlorides of iso- and terephthalic acids) have been studied inadequately. Its molecular characteristics were investigated in this study permitting evaluation of destructive processes occurring during the reprocessing of the polymer. Also evaluated were the thermophysical properties required for the calculation of heat and energy balance of the processing equipment and the rheological properties used in determining the processing parameters and energy losses. Comparison of rheological characteristics of phenylone with polyethylene showed that the density and shear stress of the former were higher by an order of magnitude. The most favorable conditions for capillary extrusion of phenylone are in the range of  $10-10^3 \text{ s}^{-1}$  at  $633 \pm 5 \text{ K}$ . When selecting equipment for phenylone processing, one must remember that its power must be considerably greater than for the processing of polyethylene. Figures 5; references 7 (Russian). [30-7813]

## EFFECT OF TREATMENT OF AUXILIARY SUBSTANCES WITH NONIONOGENIC POLYMER ON FILTRATION PROCESS

Kiev KHIMICHESKAYA TEKHNLOGIYA in Russian No 5, Sep-Oct 84 (manuscript received 10 May 84) pp 47-50

LEYCHKIS, I. M., YEREMENKO, B. V. and MALYSHEVA, M. L., Division of Petrochemistry InFOU [expansion unknown], UkSSR Academy of Sciences

[Abstract] The goal of this work was to investigate the effect of the treatment of auxiliary substances (polyvinyl chloride PVCS-70) with polyhydroxyethylene (PHE) on the filtration process. It was shown that treatment of the PVC surface with PHE resulted in diminished values of the electrokinetic  $\zeta$ -potential at all pH values evaluated, but especially with low concentrations of PHE. At pH 6.5 (positive electrokinetic potential) a much higher degree of the purification from mechanical impurities was observed than at pH 9.5 (negative electrokinetic potential). It was stipulated that with different potential signs of auxiliary substances and the suspension (as in case of pH 6.5), the attractive forces between the particles decreased due to lower values of the  $\zeta$ -potential of the filtering material; conversely, with similar signs of the charge of PVC particles and calcium carbonate (as in the case of pH 9.5), the lowering of  $\zeta$ -potential lowered electrostatic repulsion between these particles. Thus, treatment of auxiliary substances with nonionogenic polymer solution may improve or deteriorate their filtering properties depending on the charges of this substance and of the suspension particles. Figures 2; references 11: 6 Russian, 5 Western.  
[30-7813]



## RADIATION CHEMISTRY

### ARSENAL OF CHEMISTRY IS ENRICHED: COMPETITION FOR USSR STATE PRIZE

Moscow PRAVDA in Russian 10 Sep 84 p 3

[Article by Academician N. Emanuel']

[Text] D. I. Mendeleyev's famous prophecy, "The future does not threaten the periodic law with destruction, but only promises superstructure and development," is completely supported by the newest discoveries in the area of physics and chemistry.

The contemporary stage of development in the periodic law is based on achievements in quantum chemistry and research in elements with unusual valence forms. The Soviet scientists whose series of works ("New Laws of Chemical Properties and Valence State Stability for Elements in D. I. Mendeleyev's Periodic System") has been nominated to compete for the USSR State Prize for 1984, have achieved outstanding success in this direction. Colleagues of the USSR Academy of Sciences Physical Chemistry Institute, the Atomic Energy Institute imeni I. V. Kurchatov, the USSR Academy of Sciences Chemical Physics Institute and the Radium Institute imeni V. G. Khlopin participated in the works named. They discovered heretofore unknown properties of many elements in the periodic system, including the heaviest transuranic elements.

During D. I. Mendeleyev's lifetime, transuranic elements were generally unknown; only certain representatives of rare-earth groups had been found. Now, they have found broad application in various areas of the economy. Certain of them are used as sources of nuclear fuel, while others are used for manufacturing powerful lasers, semiconductors, magnets and many other modern technological materials. It is precisely in conjunction with this that the authors of the work have concentrated their intention on the study of the most important chemical properties of rare-earths and transuranic elements.

For example, they have discovered neptunium, plutonium and americium with valences of seven, which caused a sensation in the scientific world. Also, contrary to longstanding concepts, all the transuraniums have been obtained in a bivalent state, and the existence of all lanthanides in this same form has been established. These works have made possible the discovery of the basic law of change in properties of these elements in relationship to their position in the periodic system. This is very relevant for developing the technology for deriving further transuranic and rare-earth elements. The authors' research

on high and low valence forms of actinides and lanthanides have made it possible to approach in a new way the evaluation of earlier prevalent concepts on the systematization of the properties of heavy elements, developed by the American school of scientists headed by G. Siborg and the well-known French radiochemist, M. Gaysinskiy.

Into the arsenal of modern synthetic chemistry have come the most recent achievements of science--laser radiation, high-energy particle beams and plasma. Using them, Soviet chemists have obtained compounds, the existence of which had been unsuspected earlier. Thus, from time immemorial people have venerated gold because of its resistance to the action of time, due to the extreme chemical inertness of the element. Recent works by the authors have shown that under the influence of strong nonorganic oxyfluorides gold may combine with five fluorine atoms at once--that is, a previously unknown valence state of five appears.

Yet another example of the synthesis of unusual elements is the obtaining of metallic compounds stabilized in an abnormally low or even zero-valence state, close to the state of a free atom.

On the other hand, contemporary methods made it possible to study the properties of extremely unstable, short-lived states of elements governed by a high capability to combine with other elements. Thus, unusual valence forms of a number of elements, the lifetime of which is measured in millionths of seconds, were discovered and investigated by the authors of the works under review. These particles, however, play an important role in electrochemical, corrosion and other processes. Therefore, the study of their properties opens new paths in electrochemistry, in the battle with corrosion.

One of the interesting research trends is the study of the chemistry of positronium (a hydrogen-like atom, formed by a positron and an electron), which is a thousand times lighter than hydrogen. Its lifetime is measured in billionths of seconds. The study of positron reactions have made it possible to clarify the influence of mass on the chemical properties of elements, and also to solve certain questions important to the practice of chemical kinetics and catalysis.

It should be noted that it is, in fact, the Soviet scientists who have become the worthy successors to the work of D. I. Mendeleev. Moreover, the results obtained are of great practical interest. The achievements of the authors in the chemistry of transuranic elements have already exerted great influence on the creation of progressive methods for their study and analytic control. Research results in the area of unusual compounds and short-lived ions of elements within the central section of the periodic system, undoubtedly, will be used for the creation of new semiconductor materials, catalytic agents, improvements in the metallurgy of rare metals and in other processes of modern technology.

This basic research series on the laws of previously unknown properties of chemical elements is an outstanding contribution by Soviet scientists to the development of D. I. Mendeleyev's periodic law.

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CSO: 1841/11

## RUBBER AND ELASTOMERS

### SYNTHETIC RUBBER PRODUCTION AND USE IN USSR

Moscow IZVESTIYA in Russian 7 Sep 84 p 6

[Article by G. Alova: "Fate of Rubber in the Electronic Age"]

[Text] The International Conference on Raw and Cured Rubber, which has drawn 1,500 participants from 29 countries, is taking place in Moscow from 4 to 8 September. There will be 270 papers presented by scientists and specialists.

The older generation will remember, while the younger generation can read in M. Il'in's remarkable book "Tale of the Great Plan", how in the early 30's there was literally a worldwide search for plants which produced natural rubber. We had to import it from abroad in exchange for gold. Soviet automobiles of that period contained a total of 15 rubber parts, worth their weight in gold. But this was also the time when our citizen S. Lebedev was the first in the world to produce synthetic rubber industrially.

Today synthetic rubber has taken over the world, but fifty some years ago the first kilograms had not yet been tested. It was put to the test during the famous Karakum motor race. Twenty-four motor vehicles of different makes, with "rubber boots" of natural rubber or of synthetic rubber, drove 1000 kilometers with record results. It was proved that synthetic rubber satisfies the major demands placed on rubber.

I learned all of the above from Vasilii Fedorovich Yevremov, corresponding member of the USSR Academy of Sciences and president of the programming committee of the Fourth International Conference on Raw and Cured Rubber. It is interesting to note that Yevremov, at that time scientific worker at the Leningrad Synthetic Rubber Institute (now imeni S. V. Lebedev) was in charge of automobiles and trucks during the Karakum motor race.

Soviet raw isoprene rubber is similar to the natural product. Basic comprehensive research has led to the successful synthesis from this raw rubber of cured rubber in no way inferior to natural rubber. At the same time, the lifetime of tires has been increased from 40-45 to 90-100 kilometers.

There is no area of the national economy, or of human life in general, where rubber cannot be used today. Just imagine what would happen if it suddenly



disappeared. Life would continue, but without rubber there would be no electric energy, no footwear industry, no transport.

The concept of rubber itself, however, differs greatly from that of 50-60 years ago.

"Today," says A. Dontsov, assistant director of the Rubber Industry Scientific Research Institute "this concept covers a large group of composition materials which can easily change their form under the action of even small loads and return to the original form even after major deformations."

The USSR is now world leader in the production of synthetic rubbers for general use. How we have grown! There was a time when only two factories, in Leningrad and Yaroslavl, were producing synthetic rubber.

New enterprises are being constructed and existing ones are being renovated. There is widespread automation of manufacturing processes, involving the use of electronic and computer technology. We are first in the world to produce a large range of rubber products manufactured entirely of synthetic rubber.

Yes, without rubber the twentieth century would be unthinkable, although of course no-one ever calls it the "age of rubber"--how much more impressive are the "atomic", "cosmic" or "electronic" age. We must not forget, however, that we currently produce roughly 60,000 different kinds of rubber products, more than a third of which are used for technical purposes, for the manufacture of tires, regulatory membranes, seals for moving and stationary junctions, all sorts of shock absorbing parts, sound insulation and vibration-damping materials, protective coatings, drive belts, cables, etc. Approximately a third of the cured rubber produced is used to manufacture consumer goods such as footwear, raincoats, rubber gloves and toys, and for medical purposes.

The aerospace, atomic, vacuum, and radioelectronics industries use rubber products, which retain their properties under critical conditions such as high-energy radiation, intense vacuum, corrosive environments, broad temperature ranges of from -150 to +600°C, and pressures up to 500 atmospheres.

Remember how our first automobiles had only 15 rubber parts? Now the cars produced by Kamaz have 800. The average number of rubber parts in an automobile is 300-500, while an airplane has 10,000-12,000. Oceangoing ships have up to 30,000 such parts, while nuclear power plants require 50,000.

Our laboratories manufacture parts which assure the reliable operation of Il-86 and Tu-154 aircraft, of new sources of electrical energy, thermo-nuclear installations of type "Tokamak," increased capacity reactors for nuclear electric power plants, and the nuclear-powered ice breakers "Rossiya" and "Leonid Brezhnev." Nor should we forget the hermetic sealing material for space ships and space suits, which make possible the coupling of the "Salyut" and transport ships and let the cosmonauts emerge safely into open space. A new design of oxygen masks has greatly assisted Soviet mountain climbers in their ascent of Mt. Everest. The Olympic Bear soaring above Luzhniki is also the work of our chemists.

## COMPUTER CONTROL OF RUBBER PRODUCTION IN NIZHNEKAMSK

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 11 Oct 84 p 1

[Article by U. Bogdanov, Nizhnekamsk correspondent: "Under Computer Control"]

[Text] The "Nizhnekamskneftekhim" Association includes an automated plant for the production of isoprene rubber with properties predictable in advance, 95.6 percent of which earns the Symbol of Quality. This is the first operating Soviet petrochemical plant to be automated to such an extent.

"You can't manage without a guide, and you can't hope to find a better one than Vatslav Vitel'evich Krotov," says General Director of the complex N. Lemaev. "He is not only the assistant chief engineer but also the chief designer of the computer system. By the way, he was working at one of the major enterprises in Kazan' but gave it all up to join us here in Nizhnekamsk."

"How did you manage to get him interested in this, Nikolay Vasil'evich?"

"How indeed! It was hard work, to be sure. He has been offered a place in the avant garde of technological progress. Is that so little for a thinking engineer? Computerization of petrochemistry--that has a ring to it!"

Krotov introduced me to Yuriy Nilolaevich Fedorov, senior engineer and mathematician and to S. Solov'ev, head of the computer division. They are the ones who wrote the program or, as they say here, the "mathematics" of the plant's automated system for the control of the technological process. The most important part of this system is the program itself.

"What was the most difficult part of your work?" I ask Fedorov.

"The psychological barrier. At first, the operators did not trust the machine, so we introduced new ideas gradually, beginning with only a parallel information system. People quickly realized the advantages of the computer. It eliminated the danger of leaving something out. In addition, quite importantly, the ease of communicating with the computer was attractive. Special preparation was needed for mastering the simple system of keyboard commands."

I note that the scientists have not been alone in their search. A fair number of engineers, without realizing it are becoming enthusiastic about the new project; they have been helping the electronics technicians to determine the most important parameters.

R. Khisaev, head of the department of polymerization and degasification, glanced at his watch and, excusing himself, turned away from us toward the display. A few strokes on the keyboard below the screen and behold, contentedly cheeping, the computer began to display rows of figures. A brief explanation by Rev Kharifullovich made it clear that there was no cause for concern.

"Reliable information," our conversation continued, "is in itself extremely valuable for any type of decision-making. But the computer can do even more. It can see how all parts of the process are interrelated, from preparation and loading of the furnace charge and the catalytic complex to isolation and drying of the finished rubber, and it helps us to make decisions which were impossible before."

The complex technological process at the plant is hidden from view. No moving parts are to be seen. Only at the very end of the whole chain do finished briquets pop out, already packaged. The whole mystery is there inside the mighty towers, the countless pipelines. The rubber is born in the turbulent cupola of reactions, from drops in temperature and pressure. Sometimes it is enough for one "harmful" molecule to infiltrate a mixture containing millions of "useful" ones for the polymerization process to be "poisoned", producing a finished product of inferior quality.

It is not easy to say what made a breakthrough possible at a bottleneck site, and earlier this was impossible. Every machine operator, doing his own part, knew nothing of what was happening in the rest of the technological chain. For example, someone working in the polymerization division could not know what was going on in the degasification section; there was no time to get to the telephone.

Now the computer, with its omnipresence and memory reserves, multiplied by the lightning speed of its calculations, is making possible a level of control beyond man's capacity.

Quality is guaranteed above all by the stability of the process, since sharp changes in proportions of materials supplied lower the quality. The computer alone can guarantee stability over a long period of time. Foreseeing what will happen a few steps ahead, it can, without sudden changes, adjust the supplies of polymer, furnace charge, hydrogen or stabilizer, and it can react instantly to unforeseen situations.

The machine has such accurate control over technological processes that the rubber produced is on the way to becoming as good as natural rubber.

"The system also guarantees safe operating conditions," said Krotov. "The genie sealed up in the equipment is not fond of jokes. This gives us a

reliable interlocking system of levels of temperature, pressure, etc. We have placed them under the control of the program, since the machine is more vigilant than man. For instance, let us suppose that some parameter is changing and approaching a critical level. The computer immediately cuts off the flow, observing how the situation changes. If this deteriorates it cuts off the supply of hydrogen, polymer, or water and steam, or stops the feed of slurry. The automated control system has stimulated the professional growth of people, leading them to strive for new knowledge." We discussed all this with V. Burdel'nyy, superintendant of the shift, and senior operators Kh. Sabirov and V. Kalyagin, right-flank men of an intra-plant competition.

The new level of control and the incomparably more extensive and systematized information demand the achievement of new levels of specialization. It is now possible to comprehend the formerly incomprehensible--the technological process of the entire plant. This in turn leads to such a great striving for knowledge. Dozens of machine operators have finished a secondary technical school and a quarter of the workers have a college degree. This year alone several of the men have begun studying at the institute's evening program.

At the SKI-3 No 2, people are now talking with justified pride of the results of socialist competition, the thousands of tons of rubber produced over and above the plan. These successes can not be viewed separately from the use of computer technology. Since the beginning of the 5-year period this technology has been responsible for a rise in quality and productivity. During this period the computer has liberated 44 workers. Now the team is to be reduced by an additional 20 workers. There is plenty of work for everyone liberated, of course.

The computer has also been improving economic conditions. In maintaining optimal operating conditions for the production of rubber, it has conserved hundreds of tons of auxiliary materials such as isoprene and stearic acid, thousands of kilowatt-hours of electricity, and gigacalories of heat. Now the engineers, encouraged by what has already been accomplished, are dreaming of new levels of automation, which in the long run will lead to a technology run without human workers.

9832

CSO: 1841/29



## CHANGES IN MW DISTRIBUTION OF BUTYL RUBBER IN SOLUTION IN RELATION TO DEGRADATION

Moscow VYSOKOMOLEKULYARNYYE SOYEDINENIYA in Russian Vol 26, No 9, Sep 84  
(manuscript received 3 Feb 83) pp 1816-1822

VOL'FSON, S.I., KARP, M.G., ZARIPOV, I.N., YEKIMOVA, A.M. and KIRPICHNIKOV, P.A., Kazan Institute of Chemical Technology imeni S.M. Kirov

[Abstract] Changes in the MW distribution of butyl rubber (BR) in solution were analyzed in relation to degradation by ozone or  $\text{AlCl}_3$  under controlled conditions. Studies with BK-1675 samples of BR showed that the gel chromatography pattern of the MW of the degradation products indicated that polydispersion initially increased, went through the maximum, and subsequently diminished. The  $M_w/M_n$  ratio attained a numerical value of 2 only after 40-50 ruptures. These observations indicated that under the conditions employed BR did not undergo random degradation with either agent. It appears that in the case of BR degradation by either ozone or  $\text{AlCl}_3$ , degradation proceeds with a probability proportional to the number of peripheral links in the coil that are accessible to rupture. On the basis of these considerations, a model for degradation was proposed which follows the mathematical equations proposed for polymer degradation by Glynn et al. [Macromolec. Sci., 6(8): 1653, 1972]. Figures 5; references 26: 12 Russian, 14 Western.  
[19-12172]

## WATER TREATMENT

UDC 662.741--→ 628.3:622.794.22

### HSSP TYPE FILTERS IN PURIFICATION PROCESSES OF RECYCLED WATER FROM COKE-CHEMICAL PRODUCTION

Moscow KOKS I KHIMIYA in Russian No 10, Oct 84 pp 46-49

YEVZEL'MAN, I. B., VUKHIN [Eastern Scientific Research Institute of Coal Chemistry], MAYZLIK, D. L., MIROPOL'SKIY, M. U., "Tekhenergokhimprom", OBUKHOV, A. A., SAPEGIN, A. N., BELAVIN, S. L. and POD'YACHIKH, V. Ye. NTMK [Nizhniy Tagil Metallurgical Combine]

[Abstract] Experiments were performed evaluating the possibility of using high speed self-purifying (HSSP) type filters for purification of recycled water from coke-chemical production. Technological parameters of the purification process were determined (duration of the filtering cycle, pressure drop across the filter element after regeneration of the filter mesh, duration of the regeneration process, effectiveness of water purification, etc). A dual chamber vertical filter was used with single filtering element. The experiments showed that for an effective purification of coke-chemical production water, the filter used must have open mesh network. Due to the fact that granulometric composition of the suspensions being purified differs from one plant to another, each site requires independent evaluation of the filtering mesh. In general, the HSSP type filters are simple and reliable, capable of being included in automated systems. Figures 2; references 7 (Russian). [38-7813]

UDC 662.74:628.543.12+628.16.452.6

### MANAGEMENT OF CIRCULATING WATER AND SCALE PREVENTION

Moscow KOKS I KHIMIYA in Russian No 9, Sep 84 pp 35-38

MURAVKOV, P.G., ZINOV'YEVA, L.A. and VANYUSHOVA, T.A., Novolipetsk Metallurgical Combine

[Abstract] Recirculating water at coal tar chemical plants requires special treatment to maintain its utility for cooling purposes, as well as

constant monitoring to maintain required quality standards. Of primary concern is the removal of phenols and suspended particles. Prevention of incrustation has been successfully achieved by treatment of the water with hydrochloric acid solutions with admixtures of anticorrosive agents ( 5% v/v). The quality standards that should be applied in monitoring circulating water are GOST 3313-46, rather than PTE-68 standards.

References 13 (Russian).

[20-12172]

UDC 662.74.013.8:628.543.563

#### PREPARATION OF EFFLUENT WATERS FROM COAL TAR CHEMICAL PLANTS FOR BIOLOGICAL TREATMENT

Moscow KOKS I KHIMIYA in Russian No 9, Sep 84 pp 50-51

MURAVKOV, P.G., NIKONOROVA, L.N., and KONKINA, I.N., Novolipetsk Metallurgical Combine

[Abstract] Some of the problems in increasing the effectiveness of waste water treatment at coal tar chemical plants are discussed, primarily from the point of view of increasing the effectiveness of the biotreatment of water containing toxic pollutants. One of the most effective methods has been to add green vitriol to a concentration of more than 30 mg/liter. At that level the agent increases the efficiency of sedimentation in removal of tars two- to four-fold. Following treatment in the primary settling tank the water is transferred for biological treatment.

[20-12172]

UDC 662.74.004.82

#### UTILIZATION OF BYPRODUCTS OF COAL CHEMISTRY PLANTS

Moscow KOKS I KHIMIYA in Russian No 9, Sep 84 pp 51-53

MURAVKOV, P.G., KONKINA, I.N. and RAZGONOV, V.A., Novolipetsk Metallurgical Combine

[Abstract] As part of the effort to improve environmental health and diminish environmental pollution in Lipetsk, new measures were undertaken at the Lipetsk Metallurgical Concern to utilize or further detoxify by- and waste-products. Technical details are provided on the construction of new facilities and modification of existing facilities for greater efficiency in processing such products and wastes. The net result was that the heavy coal tar products, acidic resins and volatile oils are more efficiently removed from the waste waters, while in other cases work is continuing on developing effective methods to prevent air, water and soil pollution. Figures 1.

[20-12172]

UDC 634.0.813

CHEMICAL COMPOSITION OF BIRCH WOOD

Riga KHIMIYA DREVESINY in Russian No 5, Sep-Oct 84 (manuscript received 20 Sep 83) pp 48-50

MOLOTKOV, L. K., VNPO [All-Union Scientific Production Association?] of the Paper Industry

[Abstract] A study was conducted of the cellulose, lignin and pentosan contents of birch wood from various populations. Samples were taken from seven different forests in the Leningrad, Kirov and Irkutsk oblasts. In each case, approximately ten samples were selected from each of about thirty trees, at the same stage of development. The relative errors in the determinations of cellulose, lignin and pentosan were 2.3%, 2.0% and 3.3% respectively, at a 95% confidence level. The average content (% of absolute dry deresinated wood) was 49.2% for cellulose, 25.8% for pentosan and 20.9% for lignin. In no case did an individual value deviate from the average by more than three times the relative error of the measurement. The data indicate that all trees of the species *Betula pubescens* Ehrh. have the same genotype in relation to the three substances determined, independent of phenotypic variability. References 6 (Russian).

[31-12126]

UDC 634.0.813.2:674.031.21

CATECHIN CONTENT OF BIRTH (*BETULA PENDULA* ROTH.) BARK IN RELATION TO CLIMATIC CONDITIONS AND SEASON

Riga KHIMIYA DREVESINY in Russian No 5, Sep-Oct 84 (manuscript received 18 Oct 83) pp 82-84

CHERNYAYEVA, G. N., DOLGODVOROVA, C. Ya., BONDARENKO, S. M. and SHILYAYEVA, G. V., Institute of Forests and Wood imeni V. N. Sukachev, Siberian Department, USSR Academy of Sciences

[Abstract] The effect of climatic conditions, season and individual properties of the wood on flavan content was studied. Climatic variation was studied



on fifteen samples from each of four locations: Komsomol'skiy, Bakhta, Baykit and Yakutsk. Catechins were determined photocolormetrically using vanillin reagent, on ethanol extracts of bark which were cleaned up on polyamide. The highest catechin content was found in the Baykit trees and the lowest in the trees of Bakhta. However, a clear relationship between catechin content and climate type was not observed. Seasonal dynamics were studied during 1979-1980 and 1980-1981, using trees at the Institute of Forests and Wood, Yemel'yanov Rayon. The lowest catechin content was seen in May and June, connected with intensive sap rise and leaf development. During wood growth the flavan content increased, reaching a maximum with leaf yellowing and growth completion. The data indicate that climate and season have a significant effect on the catechin content of birch bark. References 7 (Russian).

[31-12126]

UDC 634.0.813.2

#### QUALITATIVE LIPID COMPOSITION OF PINE WOOD

Riga KHIMIYA DREVESINY in Russian No 5, Sep-Oct 84 (manuscript received 19 Apr 83) pp 85-88

FUKSMAN, I. L. and PON'KINA, N. A., Institute of Forests, Karelian Branch, USSR Academy of Sciences

[Abstract] In order to study the qualitative lipid composition of pine wood, a chloroform-methanol extract was fractionated on a silica gel column. The third fraction, eluted with methanol, consisted of phospholipids and was studied further by two dimensional thin layer chromatography. The first fraction, eluted with chloroform, contained fatty and resin acids. Esters of these compounds were studied by gas chromatography and IR spectroscopy. The second fraction, eluted with acetone, contained galactolipids. The first fraction was 87.43% of the total lipids, or 3.11% of the absolute dry weight of the wood; the second fraction was 10.85% of total lipids or 0.39% of dry weight and the third fraction was 1.71% of total lipids or 0.06% of dry weight. The galactolipid content of fraction two, determined colorimetrically, was 1.72% of total lipids. Similarly, the phospholipid content of fraction three was 1.25% of total lipids. Two dimensional chromatography of the phospholipids have seven spots. The major component was phosphatidylcholine (62.10% of total phospholipids); significant quantities of diphosphatidylglycerin, lesser amounts of phosphatidylglycerin and phosphatidylethanolamine and phosphatidylinositol, and small amounts of phosphatidic acid and two unidentified components were noted. The gas chromatograms revealed 52 acid components, of which 44 were fatty acids and 8 resin acids. Unsaturated fatty acids with an 18 carbon chain were 30% of the acid fraction. Figures 3; references 22: 13 Russian, 9 Western.

[31-12126]

## EFFECT OF SULFUR DIOXIDE ON RADIATION INDUCED POLYMERIZATION OF STYRENE IN WOOD

Riga KHIMIYA DREVESINY in Russian No 5, Sep-Oct 84 (manuscript received 26 Mar 84) pp 98-99

CHANGA, Ye. Ye. and ZOLDNERS, Yu. A., Institute of Wood Chemistry, Latvian SSR Academy of Sciences

[Abstract] In order to study the effect of sulfur dioxide on styrene polymerization in wood, distilled monomer and dry-ice-cooled sulfur dioxide were applied to birch wood, which was then irradiated with a  $^{60}\text{Co}$  source. The sulfur dioxide content varied from 3% to 10% of monomer content. The reaction was conducted in an inert atmosphere. Degree of polymerization was determined by the mass of the sample after dissolution of unreacted monomer. The sulfur content of the copolymer formed was greater than that of the initial mixture, indicating that in the initial stages of the reaction a complex of monomer and sulfur dioxide polymerizes preferentially. The rate of polymerization increases with increasing sulfur dioxide content. This makes it possible to reduce the dose of radiation required for complete polymerization, which improves the mechanical properties of the material obtained. Modification of wood with a mixture of styrene and sulfur dioxide increases the stability of the material to static bending by a factor of 1.3, and to compression along the fibers by a factor of 1.15, in comparison to wood modified with pure styrene. Specific resilience increased by a factor of 3.6. This is due to decreased radiolytic destruction of the wood and greater copolymer elasticity. Figures 1; references 4: 1 Russian, 3 Western.  
[31-12126]

UDC 547.992.3

## THERMODYNAMIC COMPATABILITY OF SPRUCE LIGNIN WITH DEHYDROPOLYMER AND HEMICELLULOSES

Riga KHIMIYA DREVESINY in Russian No 5, Sep-Oct 84 (manuscript received 5 Apr 84) pp 99-102

GRAVITIS, Ya. A., ANDERSONS, B. A., YAKOBSON, M. K., DUMINYA, I. K. and ERIN'SH, P. P., Institute of Wood Chemistry, Latvian SSR Academy of Sciences

[Abstract] The thermodynamic compatability of mechanically ground spruce lignin with dehydropolymer and hemicellulose was studied. The hemicellulose was obtained from spruce holocellulose by dimethyl sulfoxide extraction, while the dehydropolymer was produced by the "Zutropfverfahren" method, using m-methoxy-p-hydroxycinnamic acid and horse radish peroxidase. The molecular weight of the lignin was 8500 and that of the soluble fraction of

the dehydropolymer was 30,000, as indicated by ultracentrifugation. The mean free energy of mixing was calculated from polynomial approximations of the water vapor absorption isotherms. For all mixtures of dehydropolymer and lignin the specific free energy difference on mixing was negative, indicating that the two polymers are fully compatible. This may be due to phenol group interaction. However, the free energy difference for the lignin hemi-cellulose 1:1 mixture was 3.4 J/g, indicating incompatibility. In order to obtain complete information about lignin mixtures with dehydropolymer, enthalpy and entropy must also be studied. Figures 3; references 7: 4 Russian, 3 Western.  
[31-12126]

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